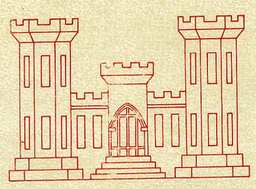
# FORT BLISS, TEXAS

# TERRAIN ANALYSIS



PREPARED BY

SOIL SYSTEMS, INC.

MARIETTA, GEORGIA 30062

UNDER THE DIRECTION OF

THE TERRAIN ANALYSIS CENTER

US ARMY ENGINEER TOPOGRAPHIC LABORATORIES

FORT BELVOIR, VIRGINIA 22060

SEPTEMBER 1978

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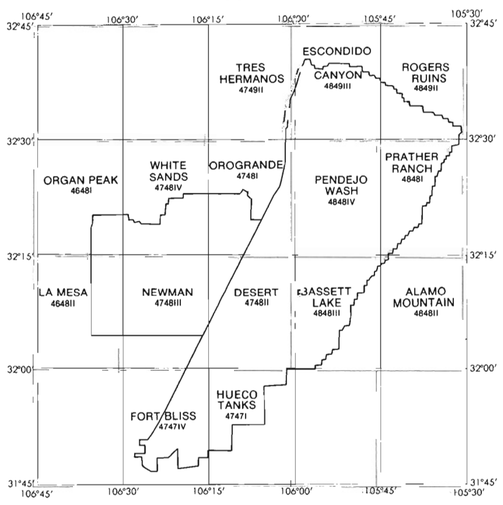
# FORT BLISS, TEXAS

# TERRAIN ANALYSIS

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# I. INTRODUCTION

## BACKGROUND

The requirement for this terrain analysis of Fort Bliss was stated in message P241854Z, October 1975, from the Commander, FORSCOM, to the Office Chief of Engineers (OCE), Department of Army, subject: "Terrain Analysis of Selected FORSCOM Installations". The FORSCOM requirement identified 13 installations (later amended to include a total of 17) including Fort Bliss, and cited topical coverage to be included in the studies. Responsibility for management and supervision of the program developed in response to the FORSCOM requirement was assigned by OCE to the Terrain Analysis Center (TAC), U.S. Army Engineer Topographic Laboratories. At FORSCOM request, TAC responsibility also includes technical supervision and direction of FORSCOM troop units assigned to the program.

Scope and content of the topical coverage included in the FORSCOM requirement were developed jointly between representatives of TAC and FORSCOM Headquarters. Analytical and cartographic specifications for the studies were developed by TAC, coordinated with OCE, and concurred in by FORSCOM Headquarters.

This study was prepared by Soil Systems, Inc., Marietta, Georgia (Contract No. DACA87-77-C0061) under the direction of TAC.

## PURPOSE

In stating the requirement for terrain analyses of selected installations, FORSCOM indicated that the purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the terrain of the installation that includes, among many other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetation, and surface drainage, all of which are treated in the studies.

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near intallations, as well as pertinent data on airfields and ports in the vicinity. This information is also treated in the studies.

Because the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. Some of the information contained in the studies may be useful as environmental baseline data, but the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

## SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and manmade features of the reservation and an evaluation of their effects on tactical military operations. The program does not include basic research to fill gaps in these data although some short-term field investigations were performed to obtain ground truth data and a general overall appreciation of the terrain. Therefore, the scope of the terrain analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by senior terrain analysts for topics such as cross-country movement, vegetation, engineering soils, engineering geology, and water resources.

The terrain analysis has necessarily involved analytical judgement in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetation and manmade features including roads, airfields, and facilities outside the cantonment areas. Remote sensing studies were also effected to fill critical data gaps, such as in mapping engineering soils.

## LIMITATIONS

The study reflects the quality, amount, and currency of the source data on which it is based. Field interviews and air photos were used to assure presentation of the latest and most reliable information. Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under Scope, the study effort was not designed to include basic research to fill gaps in data.

The presentation is cast at a level of data coverage consistent with the stated objective. Users interested in deeper pursuit of data are referred to the List of Sources in the back of the study.

## PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis. Supporting text is, as far as practicable, in tabular format keyed to the related graphics which follow. The primary map scale is 1:50,000. Four 1:50,000-scale map sheets are used for each on-post feature, with the exception of Urban Areas (Cantonment Areas). For Urban Areas the scales of the maps range from 1:9600 to 1:4800 and for off-post features the map scale is 1:1,000,000. The Defense Mapping Agency, Topographic Command (DMATC), is updating the 1:50,000-scale base maps of Fort Bliss and is producing special overprinted maps of parts of the reservation. These improved products were not available during the preparation of this analysis.

## STUDY AREA

The Fort Bliss Military Terrain Analysis covers 451,859 hectares (1,116,528 acres) in Dona Ana and Otero Counties, New Mexico, and El Paso County, Texas. The main cantonment areas are adjacent to the northeastern city limits of El Paso, Texas. El Paso is the largest city in the immediate area with an estimated 1977 population of 386,000. The installation can be reached by paved roads from U.S. Highways 54, 62, 180, State Route 7, and Interstate 10. The installation is also served by Biggs Army Airfield on post and the adjacent El Paso International Airport. The Southern Pacific Railroad serves Fort Bliss with tributary trunk lines extending to the center warehouse area, service areas, and magazine areas.

Fort Bliss, in the Basin and Range Physiographic Province, is crossed entirely by the predominantly flat, northerly-trending Tularosa Valley, which stretches 402 kilometers (250 miles) north-south and 40 kilometers (25 miles) east-west. The valley is bounded by the Sacramento Mountains to the northeast, the Otero Mesa to the east, the Hueco Mountains to the southeast, the Franklin Mountains to the west, and the Organ Mountains to the northwest. Elevations range from 1180 meters (3871 feet) above sea level in the Main Post area to 2704 meters (8870 feet) in the Organ Mountains. The vegetation of this sandy, arid land consists mainly of mesquite, creosote bush, and yucca. There are no permanent streams on the reservation and channels are confined mainly to the mountain ranges, foothills, and the Otero Mesa.

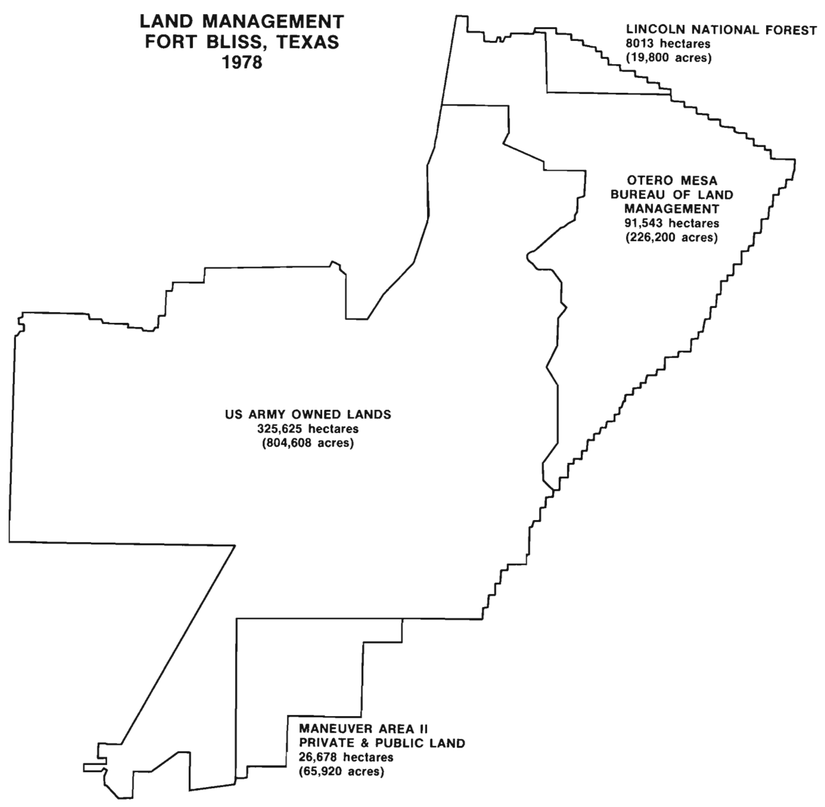
The climate is semi-arid and typical of the Southwest. Precipitation is low and averages 201 millimeters (7.9 inches) annually, with 50% of the total occurring during summer thundershowers. Summers are hot, with the mean daily maximum temperature in June, the hottest month, reaching 35°C (95°F). Winters are cool, with mean daily maximums in January, the coldest month, reaching 0°C (32°F). Dust and sand storms in the area are frequent during the months of March, April, August, and September.

The majority of the land within the Fort Bliss Military Reservation is owned and operated by the United States Army, with the exception of the following three areas:

**Maneuver Area II,** in the southern portion of the reservation, is entirely state and privately owned lands currently used as grazing land, but the Army has dual-use rights; the area can be used for maneuvers. Total area of Maneuver Area II is 26,678 hectares (65,920 acres).

**The Otero Mesa,** in the east-northeast section of Fort Bliss, is owned by the Army. Currently the Bureau of Land Management manages the land and holds the land-use rights. The land is presently leased to ranchers for grazing purposes, but the Army retains impact rights in specified sections of the area although maneuvers are not presently permitted. A total of 91,543 hectares (226,200 area) is within this area.

**The Lincoln National Forest,** in the northeast section of the reservation and within the Otero Mesa region, is owned and managed by the U.S. Forest Service. The Army has impact rights in this area. A total of 8013 hectares (19,800 acres) of National Forest land is within the installation boundary.




## SUMMARY

| MANAGEMENT RESPONSIBILITY | Area Hectares | Area Acres |
|---|---|---|
| U. S. Army | 325,625 | 804,608 |
| Bureau of Land Management | 91,543 | 226,200 |
| National Forest Service | 8013 | 19,800 |
| State of Texas | 7641 | 18,880 |
| Private | 19,037 | 47,040 |
| TOTALS | 451,859 | 1,116,528 |

# II. DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

## A. SURFACE CONFIGURATION

Fort Bliss lies within the Mexican Highland and Sacramento Section of the Basin and Range Physiographic Province. Of the five landform types on the installation, nearly flat Low Plains in the north-south trending Tularosa Valley and on Otero Mesa are the most extensive and significant, covering approximately 70 percent of the installation. The relatively flat valley floor is broken by extensive areas of low coppice dunes, while the surface of Otero Mesa is smooth and gently rolling.

Gently to moderately rolling High Plains covering approximately 19 percent of the installation occur on alluvial aprons between the bases of the Sacramento Mountains, Otero Escarpment, hills known locally as the Hueco Mountains, the Organ Mountains, and the Low Plains in the center of the Tularosa Valley. Steep-sided, moderately to deeply incised gullies in the High Plains receive high-velocity water from valleys and canyons in adjacent hills following cloudbursts. The gullies, most pronounced at the top of alluvial fans, have vertical sides, many small boulders, and depths up to 5 meters (15 feet). As the slope of the fans moderates, the large gullies divide into more numerous smaller ones. Toward the base of the slopes, there are fewer rocks and the gullies become less steep sided and very shallow, disappearing entirely upon reaching the depressions along the edge of the generally dune-covered center of the valley.

Low Hills cover approximately 7 percent of the installation and occur in the northwestern, northeastern, and southeastern parts of the installation. Most have smooth to moderately dissected gravelly surfaces with some exposed bedrock. Low Hills along Otero Mesa and in the Organ Mountains have many areas of exposed bedrock and steep faces.

High Hills cover approximately 2 percent of the installation and occur as sharp-crested, rocky, north-south trending ridges in the Organ Mountains, as the highest part of Otero Mesa Escarpment, and as rounded hilltops in the eastern portion of the installation. Slopes exceeding 100% are common; many rock outcroppings have vertical or near-vertical faces.

The Organ and Sacramento Mountains, in the northwestern and northeastern portions, cover approximately 2 percent of the installation. The Organs are very rugged, with sharp peaks and ridge crests, with many near-vertical cliffs; exposed bedrock predominates. A massive cliff forms the western face of the Sacramento Mountains, with other vertical or near-vertical cliffs in the interior areas of the mountains. Peaks in the Sacramentos are rounded and the uplands are mostly moderately rolling.

Elevation[1] extremes range from a maximum of 2704 meters (8870 feet) at Organ Peak (grid reference 542779) to a minimum of 1180 meters (3871 feet) within the main cantonment area (grid reference 653210). Maximum local relief[2] on Fort Bliss, approximately 986 meters (2939 feet), occurs in the Organ Mountains.

| LANDFORM TYPE[3] | LANDFORM DESCRIPTION AND DISTRIBUTION[4] | ELEVATION |
|---|---|---|
| 1. Low Plains | Nearly flat surfaces of a desert intermountain basin with extensive areas of sand dunes and a mesaland cover about 70 percent of the installation.<br><br>The low plains of the Tularosa Valley extend from the southern and southwestern boundaries, north through the center of the installation. Biggs Army Airfield, McGregor Range Camp, Orogrande Range Camp, Dona Ana Range Camp, the Main Post, and most other facilities are in the low plains of the valley. Small dunes cover over half of the area. The mesquite-stabilized dunes are typically oblong, 3 m (10 ft) high, 9 m (30 ft) long, and 6 m (20 ft) wide; side slopes exceed 45 percent, and dunes are spaced 8 to 17 m (25 to 55 ft) apart (base-to-base). Large irregularly shaped depressions 3 to 6 m (10 to 20 ft) in depth with gently sloping sides scattered throughout the low plains are the source for the dune material. The largest of these depressions are along the periphery of the low plains and contain water for a few days or weeks following infrequent heavy rainfall. Drainageways are entirely lacking in the center of the Tularosa Valley, and existing surface roughness from dunes and depressions is mainly the result of wind action.<br><br>The low plains on Otero Mesa are gently rolling, smooth, grass-covered, have no sand dunes or boulders, and are separated from the Tularosa Valley by an escarpment approximately 183 m (600 ft) in height. Shallow swales which are not incised trend generally northwest-southeast and provide drainage off the mesa to the southeast. Slope, generally 5 percent or less, decreases eastward from the edge of the uplifted escarpment face. | Elevations of low plains range from a low of 1180 m (3871 ft) in the main cantonment area near grid reference 653210 to a high of 1658 m (5439 ft) on the edge of the Otero Escarpment (grid reference 204671).<br><br>Elevations in the low plains portion of the Tularosa Valley typically range between 1189 m (3900 ft) and 1219 m (4000 ft). Otero Escarpment, with a height generally of 183 m (600 ft), lies between the two large areas of low plains. Otero Mesa has elevations which typically range between 1463 m (4800 ft) and 1646 m (5400 ft), much higher than those in the Valley. |
| 2. High Plains | Moderately sloping, severely dissected, rolling plains of alluvial aprons and fans in the northwestern and eastern sections of the installation form a transitional zone between the low plains and the hills and mountains on their peripheries and cover approximately 19 percent of the installation. High plains also occur as isolated rounded hillocks surrounded by low plains in the Tularosa Valley and as rolling slopes in the eastern part of the installation. Both slope and relief vary widely, but slopes range generally from 5 to 8 percent and local relief is mostly between 60 to 120 m (197 to 394 ft), with a maximum of 145 m (475 ft).<br><br>The most extensive occurrence of high plains is between the southwestern edge of Otero Mesa and the hills locally known as the Hueco Mountains in the eastern part of the installation. The lowest slope and local relief also occur here. Steepest slopes occur on the near-vertical sides of isolated hillocks north of McGregor Range Camp and south of Orogrande Range Camp. Highest relief occurs at the northern edge of Otero Mesa adjacent to the foothills of the Sacramento Mountains. The aprons are moderately dissected and the upper reaches of the slopes have deeply incised watercourses resulting from high-velocity runoff following infrequent heavy rainfall. The gullies become more numerous but less deep as the bottom of the apron is approached. Large boulders are present at the top of the fans, becoming smaller and less numerous downslope.<br><br>High plains also occur in the southern part of Otero Mesa on rolling slopes where the mesaland gradually increases in relief and adjoins the heavily weathered hills to the south. Small isolated rounded hillocks northeast, east, and southeast of McGregor Range Camp occur as high plains. | Elevations generally range between 1280 m (4200 ft) to 1524 m (5000 ft). The lowest point, approximately 1244 m (4080 ft), is on an alluvial slope west of the Hueco uplands (near grid reference 899313). The highest elevation, 2316 m (7600 ft), occurs on the installation boundary in the Sacramento Mountains (grid reference 316093). |
| 3. Low Hills | Rough, moderately rolling and rounded hills and escarpments occur in the northeastern, eastern, and northwestern portions and cover approximately 7 percent of the installation. Slopes typically range from 8 to 30 percent, with local relief generally between 200 and 250 m (656 and 820 ft). Escarpment and cliff faces have slopes ranging from 100 percent to vertical.<br><br>The largest area of low hills lies north and south of Grapevine Canyon Road (grid references 214098 to 286106). These low hills have moderately steep rocky slopes and rocky outcroppings. Hillsides and escarpment faces are moderately dissected in most areas and loose gravel, boulders, and exposed bedrock are common.<br><br>Other areas of low hills occur in the Hueco uplands, along Otero Escarpment, in the Organ Mountains northwest of the Dona Ana Range Camp, and at the tip of the Franklin Mountains southwest of the Dona Ana Range Camp. Some of these hills are steep with many rock outcrops. Areas of highest local relief and slope occur in the Hueco uplands in the eastern part of the reservation. Areas of lowest relief and slope within the type occur as relatively flat hilltops in the northeastern part of the reservation east of the Sacramento River. | Elevations are largely between 1341 and 1829 m (4400 and 6000 ft). The lowest elevation, approximately 1268 m (4160 ft) near grid reference 907312, is on the western edge of the Hueco uplands. The highest elevation, approximately 2338 m (7670 ft), is in the Sacramento Mountains (near grid reference 304092). |
| 4. High Hills | Steep, moderately dissected hills and ridges, many with boulders and with exposed bedrock, occur in the northeastern, eastern, and northwestern portions and cover approximately 2 percent of the installation. Slopes generally range from 15 to 30 percent with many slopes exceeding 100 percent. Local relief is largely between 305 and 488 m (1000 and 1600 ft).<br><br>The most significant occurrences of high hills are north of Grapevine Canyon Road (grid references 214098 to 286106) and in the Sacramento Mountains (from grid reference 251030 to grid reference 299107). High hills of the Sacramentos have steep sides, moderate dissection, and rolling crests; ridges trend generally east-west. Lowest relief and slopes are on hilltops south of Culp Canyon and on the northeastern boundary of the installation. Vertical cliffs on the western face of the Sacramentos provide the greatest relief in this landform.<br><br>The most severely dissected portions of the Otero Escarpment face (grid reference 167867) and the highest and most rugged portion of the Hueco uplands (grid reference 005418) are high hills. The escarpment is a near-vertical rock wall oriented generally north-south. The Hueco hills are isolated, rounded, and rolling, with a few exposed rock outcrops.<br><br>High hills in the Organ Mountains in the northwestern part of the installation, unlike the others, are sharply crested and peaked, with north-south trending ridges. Exposed bedrock is very common and forms cliffs in many places. | Elevations are largely between 1402 and 1707 m (4600 and 5600 ft). The lowest elevation, 1402 m (4600 ft), is on the west edge of the Hueco uplands (near grid reference 997434). The highest elevation, 2316 m (7600 ft), is in the Sacramento Mountains (near grid reference 303092). |
| 5. Mountains | Very steep mountains, with many near vertical or vertical cliffs with exposed bedrock, occur only in the extreme northwest and northeast portions and cover approximately 2 percent of the installation. Most slopes range from 30 to 60 percent with many exceeding 100 percent, and local relief is largely between 650 and 800 m (2133 and 2625 ft).<br><br>The Organ Mountains in the northwestern part of the installation are the more extensive occurrence and are sharp-crested and peaked, containing needle-like rock formations resulting from unusual jointing and erosion. Ridges show some northwest-southeast trends and cliffs are common.<br><br>The Sacramento Mountains in the northeastern part of the installation have high cliffs on western slopes. The mountain tops in the Sacramentos are smooth and rounded with little dissection. Minimum relief and slopes are in the Sacramentos along the northern installation boundary, and maximums are in the Organs. | The lowest elevation is 1311 m (4400 ft) (near grid reference 619786) and the highest, 2704 m (8870 ft) is at grid reference 542779, both in the Organ Mountains. In the Sacramento Mountains, elevations range from a low of 1433 m (4700 ft) near grid reference 192158 to 2077 m (6815 ft) at grid reference 221147. |

PASSES OF MILITARY SIGNIFICANCE

| MAP NUMBER | NAME | GRID REFERENCE FROM | GRID REFERENCE TO | MAP SHEET | MAXIMUM ELEVATION | LENGTH | WIDTH | FLANKS | IMPROVEMENTS | FORTIFICATIONS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Soledad Canyon | 582735 | 513747 | 2 | 1887 m (6190 ft) | 7.7 km (4.8 mi) | 100 to 300 m (328 to 984 ft). Canyon widens in some places but maneuver room is severely restricted. | Slopes up to 75 percent in rocky soil with some vertical sections of exposed bedrock. | Two-lane dirt road (Fort Bliss route 72), not maintained, runs through the canyon. | None | Soledad Canyon runs generally east-west, providing the only road through the Organ Mountains. The canyon lies almost entirely within the Dona Ana Impact Area and is currently off limits. |

[1]All elevations are above mean sea level.
[2]Local relief is the difference in elevation between the highest and lowest points in a given, stated distance. For computing local relief on a I:50,000 scale map, four center-adjacent grid square patterns are used; thus, the greatest horizontal distance used in computations is the length of the hypotenuse, or 2800 meters (9187 feet).
[3]Landform types have been delineated by the following parameters:
Low Plains, local relief from 0 to 50 meters (0 to 164 feet).
High Plains, local relief from 50 to 150 meters (164 to 492 feet).
Low Hills, local relief from 150 to 300 meters (492 to 984 feet).
High Hills, local relief from 300 to 600 meters (984 to 1968 feet).
Mountains, local relief in excess of 600 meters (1968 feet).
[4]Proper names of some features are not consistent with landform category definitions. Distinction between landform categories is based on local relief, not upon the degree of roughness or dissection, although these parameters were also used in the description of the major landform classes of Surface Configuration.

# B. SURFACE DRAINAGE

Fort Bliss lies almost entirely within the Tularosa Valley desert drainage basin, and only about 10 percent of the surface drainage leaves the reservation. Most of the runoff flows into the basin from all directions and evaporates, percolates into the soil, or drains into small depressions to form ephemeral lakes which retain water for only a few days or weeks. El Paso Draw, the only significant exception to the interior drainage pattern, drains southeastward on Otero Mesa, then eastward off the installation. A few remaining small areas drain across the western and southern boundaries into the Rio Grande Valley.

All streams at Fort Bliss are ephemeral and flow only for a few hours after infrequent cloudbursts, except Soledad Canyon Creek, which is intermittent. It rises in the Organ Mountains and flows from west to east in Soledad Canyon, terminating in alluvium approximately 4.2 km (2.6 mi) east of the mouth of Soledad Canyon. Fed by springs along its channel and by runoff from infrequent rains, this stream flows only from June through December, with high water in September. In years with heavier than normal snowfall, flow can start as early as March.

A typical drainage situation would occur in the following sequence. After downpours of rain at Fort Bliss, water rushes down bedrock surfaces of hills and mountains into deeply incised drainage channels in the upper portions of the alluvial slopes. Gullies quickly fill with fast-moving water which can be hazardous to personnel, equipment, or structures in the channels. Farther downslope, the runoff fans out into many spreading, steep-sided channels as deep as 5 m (15 ft) and as wide as 30 m (100 ft) in the lower foothills. At lower elevations, valleys, alluvial fans, and aprons widen as the slope decreases; water in the drainageways slows and rapidly infiltrates the highly permeable alluvial materials. The remaining flow then runs or seeps into the ephemeral lakes along the edges of the basin.

Thunderstorms occur mostly from July through September, and account for one half of the annual precipitation; flash flooding often results. Snow occurs generally from December through February, rarely accumulates to more than an inch, and seldom remains for more than a few hours.

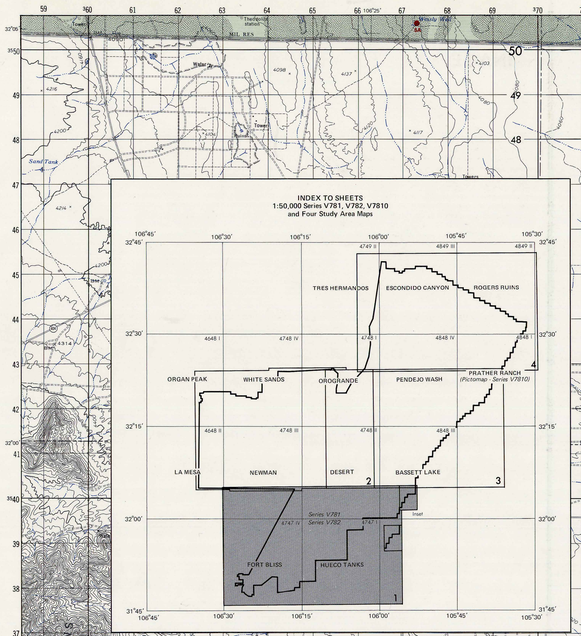
Small reservoirs impounded by earthen dams (locally known as tanks) retain runoff from infrequent heavy rainfalls and are used to water cattle and wildlife; most are east of Route US 54 on the McGregor Guided Missile Range. The small reservoirs (tanks), wells, and springs are presented on the accompanying Surface Configuration and Surface Drainage Map, and the descriptive tables for these features are in section C, Water Resources.

## OXIDATION PONDS

| MAP NUMBER | OWNERSHIP | GRID REFERENCE | MAP SHEET | APPROXIMATE WATER SURFACE AREA AT CAPACITY HECTARES | ACRES | REMARKS |
|---|---|---|---|---|---|---|
| W1 | City of El Paso | 728354 | 1 | 56.5 | 139.6 | Serves City of El Paso sewerage system. |
| W2 | City of El Paso | 740350 | 1 | 43 | 106.3 | Serves City of El Paso sewerage system. |
| W3 | City of El Paso | 732353 | 1 | 1.3 | 3.2 | Serves City of El Paso sewerage system. |
| W4 | City of El Paso | 729348 | 1 | 1 | 2.5 | Serves City of El Paso sewerage system. |
| W5 | Fort Bliss | 577569 | 2 | 1.6 | 4 | Serves Dona Ana Range Camp. |
| W6 | Fort Bliss | 886486 | 1 | 6.8 | 16.8 | Serves McGregor Range Camp. |
| W7 | Fort Bliss | 904437 | 1 | 0.2 | 0.5 | Serves Meyer Basic Training Area. |

## EPHEMERAL LAKES

| MAP NUMBER | NAME | GRID REFERENCE | MAP SHEET | APPROXIMATE WATER SURFACE AREA AT CAPACITY HECTARES | ACRES | REMARKS |
|---|---|---|---|---|---|---|
| W8 | None | 965448 | 1 | 16 | 39.5 | All lakes at Fort Bliss are ephemeral, containing water for a maximum of a few days or weeks following the rare periods of rainfall sufficient to cause ponding. Lake beds consist of fine-grained soil and are usually covered by thick grass with no visible accumulation of salts. They are usually firm enough so that some have unpaved roads crossing them. Following rainfall, however, the lake beds become soft and sticky. The lakes are in a basin drainage system and have no outlets. |
| W9 | None | 565545 | 2 | 32 | 79.1 | |
| W10 | Old Coe Lake | 694672 | 2 | 34 | 84 | |
| W11 | None | 076977 | 4 | 6.2 | 15.3 | |
| W12 | None | 071984 | 4 | 7.3 | 18 | |
| W13 | None | 069981 | 4 | 1.6 | 4 | |
| W14 | None | 152522 | 3 | 1.8 | 4.4 | |




JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 1

JOINS MAP 3

TULAROSA VALLEY

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

MCGREGOR GUIDED MISSILE RANGE

HUECO MOUNTAINS

HUECO MOUNTAINS

FRANKLIN MOUNTAINS

NEW MEXICO
TEXAS

OTERO COUNTY
EL PASO COUNTY

TULAROSA VALLEY

FORT BLISS MILITARY RESERVATION

FORT BLISS MILITARY RESERVATION

MC GREGOR GUIDED MISSILE RANGE

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY
CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## SURFACE CONFIGURATION

1. LOW PLAINS — Nearly flat surface with extensive areas of small sand dunes and a mesaland; surfaces are rough in dune areas, smooth elsewhere; local relief generally less than 12m (39 ft) and slopes mainly from 0 to 3 percent.
2. HIGH PLAINS — Moderately sloping, severely dissected and rolling plains of alluvial aprons and fans, and isolated, rounded hillocks; local relief generally between 60 and 120m (197 and 394 ft) and slopes mainly from 5 to 8 percent.
3. LOW HILLS — Rough, moderately rolling and rounded hills and escarpment faces; local relief generally between 200 and 250m (656 and 820 ft) and slopes mainly from 8 to 30 percent.
4. HIGH HILLS — Steep, moderately dissected hills and ridges, many with boulders and exposed bedrock; local relief generally between 305 and 488m (1000 and 1600 ft) and slopes largely from 15 to 30 percent with many exceeding 100 percent.

Does not appear on this map — 5. MOUNTAINS — Very steep mountains with mainly sharp peaks and some rounded crests; many near-vertical or vertical cliffs with exposed bedrock; local relief generally between 650 and 800m (2133 and 2625 ft) and slopes mainly from 30 to 60 percent with many exceeding 100 percent.

Does not appear on this map — Escarpment (slope exceeds 100 percent)

Does not appear on this map — Pass

Sand dunes

## SURFACE DRAINAGE

Intermittent watercourse (bank-to-bank gap width)

Does not appear on this map — 3-10m

Does not appear on this map — 3m

Drainageway configuration*

Does not appear on this map — A-width in m (ft); B-depth in m (ft); C-general shape

M1 — Oxidation pond or ephemeral lake

T1 — Tank

Well

Does not appear on this map — Spring

Number refers to entry in table.

* For ephemeral streams.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

WHITE SANDS MISSILE RANGE

MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST STAGE IMPACT AREA

(TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

ORGAN MOUNTAINS

SOLEDAD CANYON

DONA ANA IMPACT AREA

DONA ANA COUNTY

OTERO COUNTY

FRANKLIN MOUNTAINS

PERSHING FIRING FAN

(TEMPORARY CLOSINGS ONLY)

JOINS MAP 3

JOINS MAP 1

Scale 1:50,000

CONTOUR INTERVAL 40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS · ORGAN PEAK · WHITE SANDS · OROGRANDE · PENDEJO WASH · PRATHER RANCH (Pictomap - Series V7810) · LA MESA · NEWMAN · DESERT · BASSETT LAKE · FORT BLISS · HUECO TANKS

Series V781
4747 IV
Series V782
4747 I

# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## SURFACE CONFIGURATION

1. LOW PLAINS — Nearly flat surface with extensive areas of small sand dunes and a mesaland; surfaces are rough in dune areas, smooth elsewhere; local relief generally less than 12m (39 ft) and slopes mainly from 0 to 3 percent.
2. HIGH PLAINS — Moderately sloping, severely dissected and rolling plains of alluvial aprons and fans, and isolated, rounded hillocks; local relief generally between 60 and 120m (197 and 394 ft) and slopes mainly from 5 to 8 percent.
3. LOW HILLS — Rough, moderately rolling and rounded hills and escarpment faces; local relief generally between 200 and 250m (656 and 820 ft) and slopes mainly from 9 to 30 percent.
4. HIGH HILLS — Steep, moderately dissected hills and ridges, many with boulders and exposed bedrock; local relief generally between 305 and 488m (1000 and 1600 ft) and slopes largely from 15 to 30 percent with many exceeding 100 percent.
5. MOUNTAINS — Very steep mountains with mainly sharp peaks and some rounded crests; many near-vertical or vertical cliffs with exposed bedrock; local relief generally between 650 and 800m (2133 and 2625 ft) and slopes mainly from 30 to 60 percent with many exceeding 100 percent.

Does not appear on this map
- Escarpment (slope exceeds 100 percent)
- Pass
- Sand dunes

## SURFACE DRAINAGE

Intermittent watercourse (bank-to-bank gap width)
- 3-10m
- 3m

Drainageway configuration*
- A-width in m (ft)
- B-depth in m (ft)
- C-general shape

W1 — Oxidation pond or ephemeral lake

T1 — Tank

Well

Spring

Number refers to entry in table.

*For ephemeral streams.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

# MAP 3
# FORT BLISS, TEXAS TERRAIN ANALYSIS

## SURFACE CONFIGURATION

1. LOW PLAINS — Nearly flat surface with extensive areas of small sand dunes and a mesaland; surfaces are rough in dune areas, smooth elsewhere; local relief generally less than 12m (39 ft) and slopes mainly from 0 to 3 percent.
2. HIGH PLAINS — Moderately sloping, severely dissected and rolling plains of alluvial aprons and fans, and isolated, rounded hillocks; local relief generally between 60 and 120m (197 and 394 ft) and slopes mainly from 5 to 8 percent.
3. LOW HILLS — Rough, moderately rolling and rounded hills and escarpment faces; local relief generally between 200 and 250m (656 and 820 ft) and slopes mainly from 8 to 30 percent.
4. HIGH HILLS — Steep, moderately dissected hills and ridges, many with boulders and exposed bedrock; local relief generally between 305 and 488m (1000 and 1600 ft) and slopes largely from 15 to 30 percent with many exceeding 100 percent.
5. MOUNTAINS (Does not appear on this map) — Very steep mountains with mainly sharp peaks and some rounded crests; many near-vertical or vertical cliffs with exposed bedrock; local relief generally between 650 and 800m (2133 and 2625 ft) and slopes mainly from 30 to 60 percent with many exceeding 100 percent.

Escarpment (slope exceeds 100 percent)

Pass (Does not appear on this map)

Sand dunes

## SURFACE DRAINAGE

Intermittent watercourse (bank-to-bank gap width)

3-10m (Does not appear on this map)

3m (Does not appear on this map)

Drainageway configuration*

A-width in m (ft)

B-depth in m (ft)

C-general shape (Does not appear on this map)

Oxidation pond or ephemeral lake

Tank

Well

Spring (Does not appear on this map)

Number refers to entry in table.

* For ephemeral streams.

Scale 1:50,000

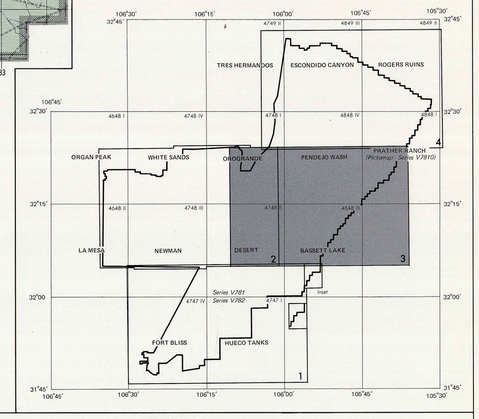
CONTOUR INTERVAL

Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheets 4848 III, 4848 IV
80 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## SURFACE CONFIGURATION

1. LOW PLAINS — Nearly flat surface with extensive areas of small sand dunes and a mesaland; surfaces are rough in dune areas, smooth elsewhere; local relief generally less than 12m (39 ft) and slopes mainly from 0 to 3 percent.
2. HIGH PLAINS — Moderately sloping, severely dissected and rolling plains of alluvial aprons and fans, and isolated, rounded hillocks; local relief generally between 60 and 120m (197 and 394 ft) and slopes mainly from 5 to 8 percent.
3. LOW HILLS — Rough, moderately rolling and rounded hills and escarpment faces; local relief generally between 200 and 250m (656 and 820 ft) and slopes mainly from 8 to 30 percent.
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5. MOUNTAINS — Very steep mountains with mainly sharp peaks and some rounded crests; many near-vertical or vertical cliffs with exposed bedrock; local relief generally between 650 and 800m (2133 and 2625 ft) and slopes mainly from 30 to 60 percent with many exceeding 100 percent.

Escarpment (slope exceeds 100 percent)

Does not appear on this map — Pass

Sand dunes

## SURFACE DRAINAGE

Intermittent watercourse (bank-to-bank gap width)

Does not appear on this map — 3-10m

Does not appear on this map — 3m

Drainageway configuration*

A-width in m (ft)

B-depth in m (ft)

C-general shape

WI — Oxidation pond or ephemeral lake

TI — Tank

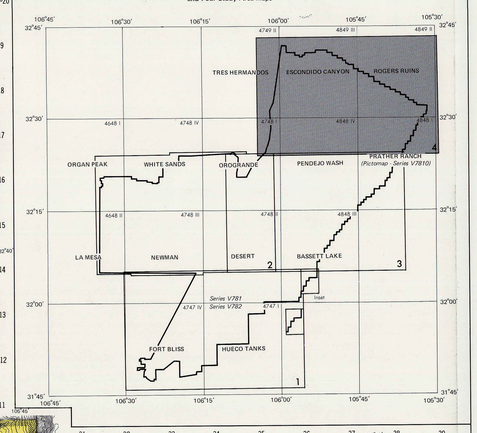
Well

Does not appear on this map — Spring

Number refers to entry in table.

* For ephemeral streams.

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

Scale 1:50,000

CONTOUR INTERVAL

Sheet 4748 I — 40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4749 II — 50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

Sheet 4848 I — 200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheet 4849 II — 40 FEET

Sheets 4848 IV, 4849 III — 50 FEET

JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# C. WATER RESOURCES

## 1. SURFACE WATER

Surface water at Fort Bliss is very scarce. Low precipitation and high temperatures are the two basic factors which contribute to this condition. There are no permanent natural streams or lakes and only one intermittent stream on Fort Bliss. The ephemeral streams flow for only a few hours or days following locally intense storms. Playa lakes formed from precipitation are usually shallow with large surface areas. A large surface area results in a high rate of evaporation; these lakes exist for only a few days or weeks.

As is typical of most areas with low precipitation, the timing between precipitation events at Fort Bliss is sporadic and the intensity is usually high. The high intensity rainfall coupled with the sparse vegetation typical of Fort Bliss results in overland flow and locally dangerous short term floods. In areas of steep slopes the streams have sharply defined channels; the channels, however, spread out and quickly disappear upon entering the relatively flat areas of the installation. When storm flow reaches the flat areas of the installation, the water usually collects in playa depressions or manmade tanks. The stored water then either evaporates or infiltrates into the soil. All drainageways on the installation are ephemeral and most drain toward the interior of the installation. Only the streams on the gently sloping east side of Otero Mesa drain off the installation. The collection of storm flow in manmade tanks (ponds constructed of soil berms) results in more efficient surface water storage than is provided by the playa lakes. The tanks are normally placed to impound the water more efficiently and are constructed to provide deeper water and less surface area exposed to evaporation.

The tanks on McGregor Range are under the jurisdiction of the Bureau of Land Management (BLM). The BLM controls livestock grazing rights on the range and maintains the tanks which are necessary for livestock and wildlife survival. Some of the tanks on the range are supplied by a BLM pipeline, and others store water impounded after rainfall. Water for the BLM pipeline is pumped primarily from the Sacramento River and Carriso Spring (sources outside the installation); the U. S. Army purchased the water rights in 1957. According to the water rights purchase agreement, the water was purchased by the Army only for the benefit of wildlife and livestock. To supplement these sources, the BLM utilizes a few small wells located around McGregor Range. The names, locations, and pumping rates for the BLM wells are in the section on Ground Water.

Only three tanks on the range are considered permanent by the BLM; these are Martin Tank, Daggar Tank, and Prather Tank. All other tanks on McGregor Range and the remainder of the installation normally impound water for only three to six months at a time. Information on the names and locations of the tanks on Fort Bliss are listed below. In addition, tank locations appear on the Surface Configuration and Drainage map.

Surface water quality is considered to be poor and suitable only for livestock. Surface water quality records are not maintained by the BLM or Fort Bliss.

**MANMADE TANKS, FORT BLISS**

| TANK NUMBER* | AND NAME | GRID LOCATION | MAP SHEET | TANK NUMBER* | AND NAME | GRID LOCATION | MAP SHEET | TANK NUMBER* | AND NAME | GRID LOCATION | MAP SHEET | TANK NUMBER* | AND NAME | GRID LOCATION | MAP SHEET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T 1 | Grey Tank | 071573 | 3 | T 28 | Payne Tank | 361831 | 3 | T 54 | Fish Tank | 148145 | 4 | T 80 | School Tank | 038557 | 3 |
| T 2 | Campbell Tank | 111606 | 3 | T 29 | Gyp Tank | 336850 | 3 | T 55 | Prather Tank** | 419877 | 4 | T 81 | Alvarado Tank No. 1 | 910579 | 3 |
| T 3 | Castner West Tank | 118572 | 3 | T 30 | Wilde Tank | 070899 | 4 | T 56 | West Tank | 269839 | 3 | T 82 | Alvarado Tank No. 2 | 956596 | 3 |
| T 4 | Castner East Tank | 119572 | 3 | T 31 | CCC Tank | 115870 | 4 | T 57 | Corral Tank | 901327 | 1 | T 83 | Borrego Tank | 985594 | 3 |
| T 5 | Childs Tank | 142564 | 3 | T 32 | Broke Tank | 222873 | 4 | T 58 | East Tank | 921285 | 1 | T 84 | South Tank | 049627 | 3 |
| T 6 | Owl Tank | 167580 | 3 | T 33 | Double Tank | 254895 | 4 | T 59 | Tiger Tank | 919343 | 1 | T 85 | Wallbridge Tank | 086414 | 1 |
| T 7 | Foster Ranch North Tank | 161563 | 3 | T 34 | Godfrey Tank | 292880 | 4 | T 60 | Mesquite Tank | 949360 | 1 | T 86 | Big Cement Tank | 061438 | 1 |
| T 8 | Foster Ranch South Tank | 161562 | 3 | T 35 | Van Winkle Tank | 400923 | 4 | T 61 | Coyote Tank | 947327 | 1 | T 87 | Little Cement Tank | 070434 | 1 |
| T 9 | Escondida Tank | 180541 | 3 | T 36 | Gravel West Tank | 327906 | 4 | T 62 | San Juan Tank | 936294 | 1 | T 88 | Red House Tanks | 086481 | 1 |
| T 10 | Green Tank | 156630 | 3 | T 37 | Gravel East Tank | 328907 | 4 | T 63 | Kerby Tank | 952375 | 1 | T 89 | Ivan Grey Tank | 139498 | 1 |
| T 11 | Tinney tank | 072660 | 3 | T 38 | Road Tanks | 245927 | 4 | T 64 | Eighteen Tank | 992383 | 1 | T 90 | Hackberry Tank | 083517 | 3 |
| T 12 | Tripod Tank | 269676 | 3 | T 39 | Pendejo Tank | 166916 | 4 | T 65 | Scott Tank | 653619 | 2 | T 91 | Double Tank | 252895 | 4 |
| T 13 | Broyle Tank | 142666 | 3 | T 40 | Lee Tank | 133931 | 4 | T 66 | Pit Tank | 693664 | 2 | T 92 | McGregor Tank | 048822 | 3 |
| T 14 | Road Tank | 054695 | 3 | T 41 | Wright Tank | 150939 | 4 | T 67 | Goodin Tank | 675703 | 2 | T 93 | Mesa Horse Camp Tank | 286849 | 3 |
| T 15 | Lower Big Mack Tank | 140700 | 3 | T 42 | West Poe Tank | 263961 | 4 | T 68 | Dripping Springs Tank | 537700 | 2 | T 94 | Unnamed Tank | 192635 | 3 |
| T 16 | Upper Big Mack Tank | 142700 | 3 | T 43 | Middle Poe Tank | 291960 | 4 | T 69 | Lower Tank | 520713 | 2 | T 95 | Unnamed Tank | 313742 | 3 |
| T 17 | Corner West Tank | 280701 | 3 | T 44 | Rutherford Tank | 343944 | 4 | T 70 | Chimney Rock Tank | 516744 | 2 | T 96 | Unnamed Tank | 391953 | 4 |
| T 18 | Corner East Tank | 281701 | 3 | T 45 | Daggar Tank** | 452960 | 4 | T 71 | McNew Feeder Tank | 873851 | 2 | T 97 | Unnamed Tank | 319975 | 4 |
| T 19 | Martin Tank** | 219728 | 3 | T 46 | Crest Garden Tank | 416991 | 4 | T 72 | McNew South Tank | 927794 | 2-3 | T 98 | Unnamed Tank | 320953 | 4 |
| T 20 | Little Mack Tank | 119732 | 3 | T 47 | El Paso Tank | 364986 | 4 | T 73 | Lake Tank | 967442 | 1 | T 99 | Unnamed Tank | 329957 | 4 |
| T 21 | Sulphur Tank | 043742 | 3 | T 48 | Spring Tank | 232972 | 4 | T 74 | New Tank | 009486 | 1 | T 100 | Unnamed Tank | 160968 | 4 |
| T 22 | Big Tank | 271750 | 3 | T 49 | Sheep Tank | 368001 | 4 | T 75 | Coyote Tank | 975499 | 1 | T 101 | Unnamed Tank | 162968 | 4 |
| T 23 | End of Line Tank | 286749 | 3 | T 50 | Escondida Tank | 072083 | 4 | T 76 | Big Tank | 950520 | 3 | T 102 | Unnamed Tank | 164969 | 4 |
| T 24 | Hay Meadow Tank | 175783 | 3 | T 51 | Boone Tank | 143084 | 4 | T 77 | Flat Tank | 013524 | 3 | T 103 | Unnamed Tank | 104120 | 4 |
| T 25 | Middle Tank | 090772 | 3 | T 52 | Sand Tank | 121106 | 4 | T 78 | Charley Tank | 054525 | 3 | T 104 | Unnamed Tank | 096132 | 4 |
| T 26 | Little Crocket Tank | 121820 | 3 | T 53 | Tony Tank | 098144 | 4 | T 79 | Chaparral Tank | 986541 | 3 | T 105 | Lucky Tank | 174682 | 3 |
| T 27 | Little Tank | 239828 | 3 | | | | | | | | | | | | |

*Tanks are indicated by number on the Surface Configuration and Drainage map.
**Considered permanent tanks by BLM.
NOTE: Several tanks have the same names.

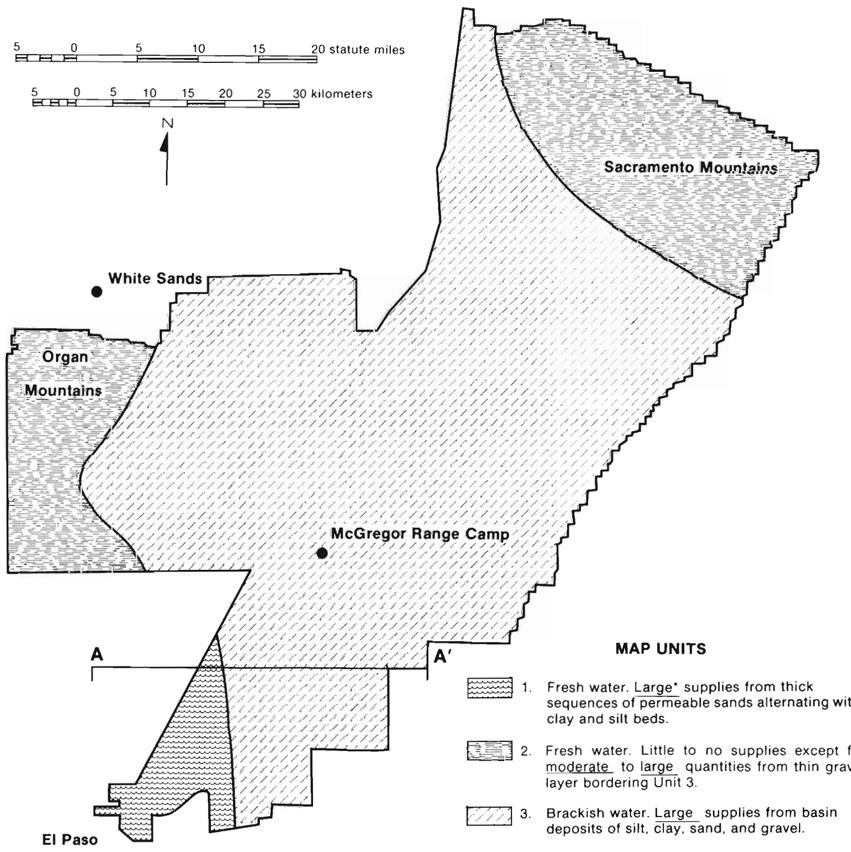
## 2. GROUND WATER

Large quantities of fresh water from deep wells are available in the extreme southwestern part of Fort Bliss, in the vicinity of Biggs Army Airfield. This fresh ground water, occurring in sands and gravels at depths of 80 to 400 meters (262 to 1312 feet), is the middle portion of a more extensive water-bearing zone that is shared by Fort Bliss and the cities of El Paso and Juarez. The eastern slopes of the Franklin Mountains, west of the installation, furnish much of the recharge to this water-bearing zone. The aggregate pumpage of ground water is greater than the recharge; therefore, a slow but significant decline in water levels is noted. Ground water levels at pumping locations, now as much as 100 meters (328 feet) below land surface, are expected to decline another 13 meters (43 feet) by 1990.

To the east and northeast of Biggs Army Airfield, the ground water in the extensive valley deposits becomes salty and the beds are less permeable than those in the vicinity of Biggs Army Airfield. The mountain slopes on the east and west of the Tularosa Valley are underlain by poorly fractured consolidated rocks that generally yield little or no water, although along some gravelly lower slopes small to moderate fresh water supplies may be available. Thus, water of inferior quality, as well as rock formations that yield little or no water, underlie more than 90 percent of Fort Bliss. A few ephemeral springs located in some of the higher mountains on Fort Bliss normally flow for only a few weeks immediately following precipitation. The names and grid locations of springs are in the table below.

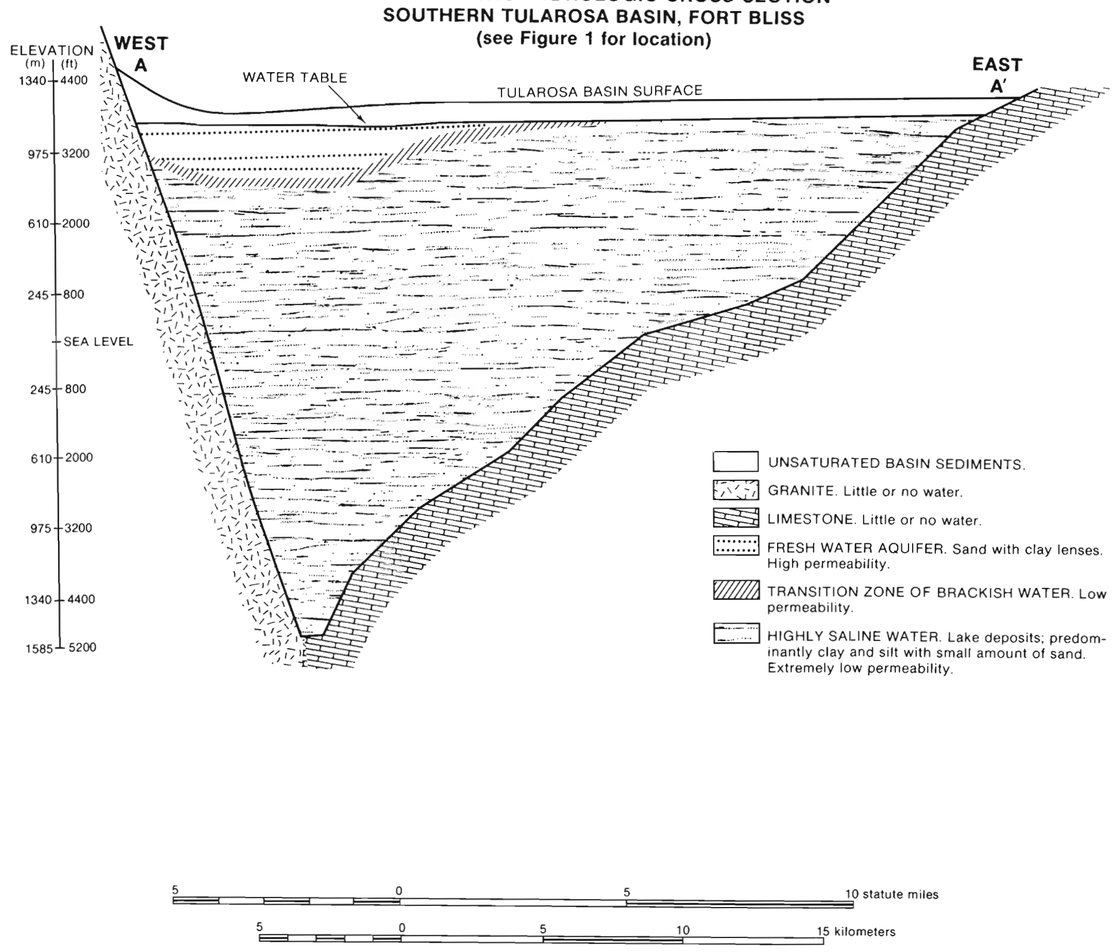
Ground water units on Fort Bliss are depicted in Figure 1. A cross section through the Tularosa Basin (Figure 2, located as A - A' on Figure 1) indicates that the quantity of fresh water is significantly smaller than the quantity of saline water. In the future, as the quantity and quality of the fresh water decrease, use of desalinization plants would increase the usable water supply. Tables are presented depicting the names or numbers and locations of the producing wells on Fort Bliss, ground water quality analysis for the Fort Bliss area, and the names and locations of abandoned wells on the installation. The wells were abandoned because of low production rates or poor quality water.

**FIGURE 1**
**GROUND WATER UNITS, FORT BLISS**




Line A-A' shows the location of a Diagrammatic Hydrologic Cross-Section of the Southern Tularosa Basin at Fort Bliss (Figure 2).

**FIGURE 2**
**DIAGRAMMATIC HYDROLOGIC CROSS-SECTION SOUTHERN TULAROSA BASIN, FORT BLISS**
**(see Figure 1 for location)**



# 2. GROUND WATER (Continued)

| MAP UNIT | QUANTITY AND SOURCE | DEPTH | QUALITY | DEVELOPMENT OF SOURCES |
|---|---|---|---|---|
| 1 Large supplies of fresh water from thick sequences of permeable sands alternating with clay and silt beds. | Large* quantities of water available from deep wells penetrating thick sequences of permeable sands alternating with clay and silt beds. Well yields range from about 378 to 5677 lpm (144,000 to 2,160,000 gpd). Several wells pumping collectively for more than 50 years have developed a cone of depression as much as 20 m (66 ft) deep at Biggs Army Airfield. Yet more than 225 m (738 ft) of saturated deposits of fresh water lie below the pumping levels. Yields of wells are consistent, with no variation between wet and dry seasons.<br><br>The specific capacity of the wells ranges from about 19 lpm (5 gpm) to more than 76 lpm (20 gpm) per foot of drawdown. The higher specific capacities coincide with an area of high transmissivity (more than 263 lpm or 69 gpm per foot of drawdown) in the extreme southwestern tip of the installation, in the vicinity of Biggs AAF. Springs are totally absent because the water table is more than 75 m (246 ft) below land surface.<br><br>Ground water moves generally southward in the sand and gravel beds. General southward movement has been partly reversed in the vicinity of Biggs AAF by lowered water levels resulting from heavy pumping of water. Combined withdrawal of ground water by the City of El Paso and Fort Bliss may lower the ground water levels an additional 13 m (43 ft) by 1990. Recharge is largely from runoff of precipitation from the eastern slopes of the Franklin Mountains northwest of the Airfield, where recharge water can readily infiltrate through the gravelly lower slopes of the mountains. | Most of the wells range in depth from 175 m (574 ft) to 330 m (1083 ft). The upper 75 to 100 m (246 to 328 ft) of the well depths are above the water table. | Potable water occurs in the permeable sands and gravels of Unit 1. The water commonly contains between 300 and 1000 milligrams per liter (mg/l) · of total dissolved solids at depth intervals below the land surface of 90 to 225 m (295 to 738 ft). The fresh water zone, above 225 m (738 ft), contains water that rates from moderately hard to hard, but no constituent exceeds the maximum for safe drinking water standards. Below 300 m (984 ft) the water increases in salinity with increasing depth. In general, the chloride content of the water increases gradually below a depth of 150 m (492 ft), and some of the water at a depth of 225 m (738 ft) has a chloride content of about 500 mg/l. Representative examples of water quality analyses are given in a table below.<br><br>A possible source of contamination of the water supply is the underlying saline water, which may present a problem in the foreseeable future. The saline water below the fresh water zone occurs chiefly in clays and silts of low permeability and cannot easily move upward to mix with the fresh water. However, a gradational zone of brackish water extends between the fresh water zone and the deeper saline water, and heavy concentrated pumping can pull the brackish water upward into the present supply. By proper well-field planning, at least 50 percent of the fresh water presently in storage can probably be recovered before it becomes non-potable.<br><br>The likelihood of contamination from waste disposal practices, such as wastewater lagoons, sanitary landfills, septic tanks, and spills, is remote. The great depth to the water table, coupled with the high absorptive capacity of the clayey material above the water table, allows attenuation of contaminants and thus will probably prevent contamination. | The wells range in diameter from 25 cm (9.8 in) to 62 cm (24.4 in). The wells are cased to the top of the first permeable bed below the water table; as many as 10 screens, averaging about 8 m (26 ft) long, are placed opposite each permeable bed below the first, and the connecting pipe and screens commonly extend to a depth of about 225 m (738 ft). Pumping tests have been systematically made to determine the hydraulic characteristics of the aquifer in the vicinity of each well. The problem of the subsiding water table in the existing well fields has been identified and discussed, but no definite plans for future supplies of water have been developed. |
| 2 Little to no supplies of fresh water except for moderate to large quantities from thin gravel layer bordering Unit 3. | Large areas of mountain slopes composed of exposed bare rock which yield little or no water. Lower slopes near Tularosa Basin contain sufficient sand and gravel locally to indicate usable quantities of fresh water. This unit in the area of the Organ Mountains serves as a partial recharge area for water supplies at El Paso and Fort Bliss. There is no significant development of ground water in Unit 2, and potential for development is not known. No large springs exist; some small ephemeral springs are confined to coves in the highest mountain areas. There are too few wells to determine yield and aquifer characteristics. An intermediate zone between steep rock slopes and a lower zone bordering Unit 3 may have a thin water-carrying gravel layer at the contact of the shallow underlying bedrock. This saturated material in places is less than 1 m (3 ft) thick and therefore not suitable for conventional withdrawal of water. The lowest topographic zone, grading into Map Unit 3, contains sufficient gravel and sand above bedrock to provide moderate to large supplies of water. | Well depths are highly variable, 10 to 40 m (33 to 131 ft), depending upon well placement in the mountain coves and valleys. | Overall quality of water is unknown but its rapidly circulating character suggests that it has, in most places, low mineral matter in solution and good quality. | Drill sites for wells into bedrock may not be accessible because of uneven topography. Open-end wells, without screens, would be suitable. Wells in gravels and sands on lower gentle slopes should be screened, similar to production wells near El Paso. |
| 3 Large supplies of brackish water from basin deposits of silt, clay, sand, and gravel. | Alluvial basin deposits of silt, clay, sand, and gravel merge into the sand and gravels of Unit 1 near El Paso, but the yield of wells is generally less than 1135 lpm (432,000 gpd). Water is commonly brackish. No significant development of ground water. | Depth to the water table and aquifer is about 60 m (197 ft) in most places. | Deeper water is saline and water immediately below the water table is generally hard and in many places brackish. | If the saline ground water resources of this unit are used in the future, wells should be screen or gravel-wall type. |

Definitions of underlined terms are as follows:

| Volume Terms | Liters Per Minute (lpm) | Gallons Per Day (gpd) | Quality Terms |
|---|---|---|---|
| Large | 400-4000 | 150,000 - 1,500,000 | Brackish - total dissolved solids 1500 mg/l to 15,000 mg/l |
| Moderate | 40 - 400 | 15,000 - 150,000 | Saline - total dissolved solids in excess of 15,000 mg/l |

+For purposes of this study mg/l may be taken to be roughly equivalent of parts per million (ppm).

## PRODUCING WELLS, FORT BLISS*

| MAP NUMBER/ WELL NUMBER OR NAME | GRID LOCATION | MAP SHEET | CAPACITY liters per minute | CAPACITY gallons per day | REMARKS |
|---|---|---|---|---|---|
| 1 5 | 648205 | 1 | 3974 | 1,512,000 | On Fort Bliss Main Post |
| 2 6 | 654206 | 1 | 3785 | 1,440,000 | On Fort Bliss Main Post |
| 3 7 | 660206 | 1 | 4466 | 1,699,200 | On Fort Bliss Main Post |
| 4 9 | 644205 | 1 | 3179 | 1,209,600 | On Fort Bliss Main Post |
| 5 10 | 671256 | 1 | 3974 | 1,512,000 | In Tobin Well Field |
| 6 11 | 671266 | 1 | 4163 | 1,584,000 | In Tobin Well Field |
| 7 12 | 686266 | 1 | 3179 | 1,209,600 | In Tobin Well Field |
| 8 13 | 686256 | 1 | 3104 | 1,180,800 | In Tobin Well Field |
| 9 14 | 686284 | 1 | 3747 | 1,425,600 | In Tobin Well Field |
| 10 15 | 696283 | 1 | 3936 | 1,497,600 | In Tobin Well Field |
| 11 16 | 702267 | 1 | 4012 | 1,526,400 | In Tobin Well Field |
| 12 1A | 681222 | 1 | 3709 | 1,411,200 | On Biggs Army Airfield |
| 13 2A | 690223 | 1 | 3633 | 1,382,400 | On Biggs Army Airfield |
| 14 2 | 584579 | 2 | 1703 | 648,000 | At Dona Ana Range Camp |
| 15 3 | 578581 | 2 | 1703 | 648,000 | At Dona Ana Range Camp |
| 16 3 | 714535 | 2 | 946 | 360,000 | At Hueco Range Camp |
| 17 2 | 770199 | 1 | 83 | 31,680 | At Site Monitor |
| 18 Mary Toy | 382825 | 3 | 30-38 | 11,520-14,400 | Owned by Bureau of Land Management, services livestock tanks |
| 19 Prather | 419878 | 4 | 30-38 | 11,520-14,400 | Owned by Bureau of Land Management, services livestock tanks |
| 20 Langford | 123136 | 4 | 11-19 | 4320-7200 | Owned by Bureau of Land Managment, services livestock tanks |
| 21 Fish Tank | 148145 | 4 | 11-19 | 4320 - 7200 | Owned by Bureau of Land Management, services livestock tanks |
| 22 Nations East | 865290 | 1 | 57 | 26,600 | On Hot Wells Ranch, services livestock tanks |

*Wells and springs indicated on the Surface Configuration and Drainage map.

## ABANDONED WELLS, FORT BLISS*

| MAP NUMBER/NAME | GRID LOCATION | MAP SHEET |
|---|---|---|
| 1A Hells Hole Well | 813268 | 1 |
| 2A McElroy Well | 788248 | 1 |
| 3A Bakers Well | 716239 | 1 |
| 4A Joint Well | 864369 | 1 |
| 5A Wessly Well | 673505 | 1 - 2 |
| 6A Goodin Well | 688694 | 2 |
| 7A Globe Well | 681736 | 2 |
| 8A Rose Well | 114089 | 4 |
| 9A Wilde Well | 069901 | 4 |
| 10A Cox Well | 074976 | 4 |
| 11A Benton Well | 043845 | 3 |
| 12A Hot Well | 932415 | 1 |

## SPRINGS, FORT BLISS*

| MAP NUMBER/NAME | GRID LOCATION | MAP SHEET |
|---|---|---|
| 1 Globe Spring | 605764 | 2 |
| 2 Pine Spring | 572761 | 2 |
| 3 Rock House Springs | 542785 | 2 |

Quality analysis unavailable

# 2. GROUND WATER (Continued)

## GROUND WATER QUALITY ANALYSIS, FORT BLISS AREA

| WELL NUMBER / WELL LOCATION | | 1A BIGGS AAF | 2A BIGGS AAF | 5 MAIN POST | 10 TOBIN FIELD | 11 TOBIN FIELD | 12 TOBIN FIELD | 3 HUECO CAMP | 3 DONA ANA CAMP |
|---|---|---|---|---|---|---|---|---|---|
| WATER QUALITY PARAMETER | UNITS | | | | | | | | |
| Silica ($SiO_2$) | mg/l[1] | 32 | 30 | 36 | 31 | 40 | 37 | 39 | 31 |
| Iron (Fe), dissolved | mg/l | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.12 | 0.03 |
| Iron (Fe), total | mg/l | 0.08 | 0.27 | 0.00 | 0.00 | 0.01 | 0.01 | * | 0.06 |
| Calcium (Ca) | mg/l | 33 | 34 | 37 | 25 | 26 | 19 | 136 | 42 |
| Magnesium (Mg) | mg/l | 9.6 | 9.7 | 12.0 | 8.3 | 8.2 | 5.6 | 33.5 | 18.0 |
| Potassium (K) | mg/l | 155 | 156 | 56 | 124 | 120 | 84 | 15 | 69 |
| Bicarbonate ($HCO_3$) | mg/l | 162 | 160 | 190 | 190 | 196 | 162 | * | 259 |
| Carbonate ($CO_3$) | mg/l | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 |
| Sulfate ($SO_4$) | mg/l | 139 | 139 | 42 | 92 | 87 | 51 | 34 | 57 |
| Chloride (Cl) | mg/l | 126 | 130 | 39 | 78 | 72 | 41 | 438 | 27 |
| Fluoride (F) | mg/l | 0.06 | 0.06 | 0.80 | 1.40 | 1.20 | 0.90 | 0.52 | 0.04 |
| Nitrate ($NO_3$) | mg/l | 3.4 | 5.0 | 8.7 | 4.8 | 5.9 | 7.9 | 4.0 | 21.0 |
| Dissolved Solids: Calculated (Sum) | mg/l | 579 | 583 | 324 | 456 | 456 | 326 | 1448 | 394 |
| Hardness as $CaCO_3$ | mg/l | 122 | 125 | 142 | 96 | 98 | 70 | 475 | 177 |
| Non-carbonate hardness | mg/l | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 |
| Alkalinity as $CaCO_3$ | mg/l | 133 | 131 | 156 | 156 | 161 | 133 | 66 | 212 |
| Sodium | % | 73 | 73 | 46 | 74 | * | 72 | * | 49 |
| Carbon dioxide | mg/l | 6.5 | 19.0 | 9.5 | 7.6 | 6.3 | 5.2 | * | 5.2 |
| Specific Conductance | µmhos[2] | 970 | 966 | 524 | 756 | 736 | 524 | 1527 | 586 |
| pH | none | 7.6 | 7.6 | 7.5 | 7.6 | 7.7 | 7.7 | 7.8 | 7.9 |

1 - milligrams per liter

2 - micromhos at 25°C

* - not analyzed

For permissible concentrations of impurities in military water supplies, see Department of the Army Technical Manual PM 5-700, Field Water Supply, July 1967, paragraph 19, or other applicable manuals or regulations.

# D. ENGINEERING SOILS

This table and the accompanying Engineering Soils map indicate general soil characteristics and distribution of the major soil groups on Fort Bliss. This information is adequate for general planning purposes but it is not intended to supplant detailed on-site investigations for design purposes.

The Engineering Soils map was developed after stereoscopic examination of aerial photographs of Fort Bliss. Information was also obtained from the published U.S.D.A. Soil Conservation Service Soil Survey of El Paso County, Texas (November, 1971) and the preliminary, unpublished soil surveys of Dona Ana and Otero Counties, New Mexico. Low-altitude aerial surveys and on-site investigations were made of selected sites as well. Soil samples were taken and laboratory tests were made. Soils were then grouped into twelve map units. Each unit contains similar landforms and soils which have similar engineering characteristics. Once grouped, map units were evaluated for six common engineering applications, and limitations (slight, moderate, or severe) were noted. The characteristics causing the limitations are listed in a legend at the bottom of the table. The soil profiles shown below are very general and are "average" typical profiles; actual conditions may vary to some extent, especially the thickness of the layers and depth to bedrock or caliche. In addition, within each map unit are soils whose textural profiles differ from the model.

Fort Bliss is in the Trans-Pecos (Texas) Southern Desert (New Mexico) resource region. There are four primary physiographic units on the reservation: first, the broad alluvial plains of the intermountain basin; second, the pediments and alluvial aprons adjacent to the mountains; third, the elevated tableland or plateau known as the Otero Mesa; and, fourth, the igneous and/or sedimentary mountainous areas on the eastern and western sides of the reservation.

The intermountain basin includes sections of dunes and non-dune areas. The dunes are predominantly sandy. Non-dune areas are generally silt loam (ML) and are identifiable in the landscape as level to slightly concave regions between the desert flats and alluvial apron of the mountains. Many of the soils in the basin contain indurated caliche.

The soils of the pediment and alluvial aprons contain appreciable amounts of gravel. Slopes are moderately steep and complex, and dry washes dissect the slopes in many places. These dry washes are often hazardous following thunderstorms when they fill with a torrent of water. Many of the soils in this area contain layers of indurated caliche.

The nearly level to gently sloping soils of the Otero Mesa are generally favorable for construction and military operations. However, the moderate depth to bedrock and areas of indurated caliche are limiting factors for engineering use in some places.

The mountainous areas are characterized by extremely shallow depth to bedrock and steep slopes which present severe problems in construction, military operations, and cross-country movement.

Although the surface is nearly level to gently sloping in most areas, use of the soils in the intermountain basin for construction, military operations, and cross-country movement is limited. Blowing sand restricts visibility and can irritate or injure the eyes of personnel. In many non-dune areas, soils lose bearing strength when wet and can be treacherous or impassable following rainfall. Dune areas necessitate a circuitous route which reduces the rate of advance in cross-country movement.

The availability of sand and gravel for construction purposes on Fort Bliss is only fair because of the significant amount of silts and clays contained in the sand and gravel. It is a common practice to excavate the soil to the indurated caliche layer and to crush the caliche to obtain coarse-grained material for use in construction. Some limestone is also quarried and crushed for construction purposes.

Sediments in the intermountain basin are estimated to be greater than 1500 m (5000 ft) thick. Depth to bedrock is either very shallow or very deep, reflecting the break between rock outcrops of the mountain blocks and the deeply buried rock down-dropped along steep fault planes bounding the basin.

**SOIL CHARACTERISTICS AND SELECTED EVALUATIONS**

| MAP UNIT | AREA MAPPED ON RESERVATION KM² (MI²) | LANDFORM AND SLOPE | TYPICAL SOIL PROFILE[1]-LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION[2] (PROFILES NOT TO SCALE) | PERMEABILITY | SHRINK-SWELL POTENTIAL | CALICHE[3] | RATING AND MAJOR LIMITING SOIL CHARACTERISTICS FOR: SEWAGE LAGOONS | SANITARY LANDFILL | FOUNDATION FOR SMALL BUILDINGS | ROAD LOCATION | SHALLOW EXCAVATION | TRAFFICABILITY | MAJOR SOIL ASSOCIATION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 536 km² (207 mi²) | Shallow depressions, broad floodplains, and wide waterways in the intermountain basin and a very limited area on the Otero Mesa. Slopes nearly level to concave in the 0 to 2 percent range. | cm<br>ML — Silt loam to very fine sandy loam<br>33<br>CL-ML — Silt loam to silty clay loam to very fine sandy loam, gypsiferous in some areas. See remarks.<br>Depth to bedrock is >6 m (>19.5 ft) | Slow<br>Moderate | Low<br>Moderate | None | Severe<br>f | Severe<br>f | Severe<br>f | Severe<br>f | Severe<br>f | Slight when dry, severe when soil is saturated or flooded | Major Soil Associations:[4] Mimbres-Prelo, Mimbres-Tome, Reyab-Armesa, Playas and Berino-Dona Ana and Turney-Berino. Flooding after thunderstorms is the main hazard. The ML soils have a low bearing strength when saturated. Blowing soil is also an occasional hazard. A small area of the Holloman-Reeves association is included in this unit and appears in the northernmost portion of the reservation adjacent to U.S. Highway 54. These soils are highly gypsiferous, soluble in water, and corrosive. |
| 2 | 94.5 km² (36.5 mi²) | Nearly level to gently sloping outwash plains in the intermountain basin. Slopes in the 0 to 2 percent range. | cm<br>SM or SC — Fine sandy loam<br>25<br>SM-SC or CL — Fine sandy loam to sandy clay loam<br>60<br>Ca — Caliche<br>122<br>SM-SC — Fine sandy loam to sandy clay loam<br>Depth to bedrock is >6 m (>19.5 ft) | Moderate to Rapid<br>Slow<br>Slow<br>Moderate | Low<br>Moderate<br>Moderate<br>Low to Moderate | Weakly cemented to soft and powdery, highly calcareous. Layer occurs from 60 to 122 cm (24 to 48 in) in depth. | Moderate<br>e,h | Moderate<br>e,h | Slight<br>h | Slight<br>h | Slight<br>h | Slight to Moderate<br>h | Major Soil Associations: Dona Ana-Berino, Berino-Bucklebar and Turney-Berino. The blowing of surface soil and moderate dissection of certain areas appear to be the only inconveniences. There are no significant sand dunes in this unit; however, much of the surface has been winnowed by the wind. |
| 3 | 1215 km² (469 mi²) | Gently sloping to undulating outwash plains of the intermountain basin. Generally covered by stabilized sand dunes (coppice dunes).[5] Dune heights generally 2 m (6.5 ft). Slopes (excluding dunes) in the 0 to 5 percent range. | cm<br>SP-SM — Loamy fine sand to fine sandy loam<br>20<br>SM-SC to CL-ML — Sandy clay loam to silty clay loam<br>75<br>SM-SC — Sandy loam<br>Depth to bedrock is >6 m (>19.5 ft) | Rapid<br>Slow to Moderate<br>Moderate to Rapid | Low<br>Moderate<br>Low to Moderate | None | Severe<br>e,h | Severe<br>e,h | Moderate<br>l | Moderate<br>h,l | Slight to Moderate<br>h | Slight to Moderate<br>h | Major Soil Associations: Berino-Pintura, Pintura-Dona Ana, Onite-Pintura and Bluepoint-Onite-Wink. Blowing sand is a major hazard. Sand dunes necessitate a circuitous route which reduces rate of advance in cross-country movement. Profile diagram reflects soils in interdune areas and not the dunes per se. The dunes are chiefly composed of poorly graded sand (SP) and silty sand (SM). |
| 4 | 334 km² (129 mi²) | Undulating outwash plains and relic lake beds of the intermountain basin. Mostly covered by large eroding steep-sided coppice dunes. Dune heights generally 3 m (10 ft). Slopes (excluding dunes) in the 0 to 5 percent range. | cm<br>SM,ML — Very fine sandy loam to fine sandy loam<br>10<br>SM-SC or CL-ML — Sandy clay loam to silt loam and sandy loam<br>95<br>SM-SC or CL-ML — Sandy loam to stratified, gypsiferous, lake bed sediments<br>Depth to bedrock is >6 m (>19.5 ft) | Moderate<br>Moderate to Slow<br>Moderate to Slow | Low<br>Moderate<br>Moderate | None | Severe<br>e,h | Severe<br>e,h | Moderate<br>l | Moderate<br>h,l | Slight to Moderate<br>h | Slight to Moderate<br>h | Major Soil Association: Pintura-Tome-Dona Ana. Blowing sand and the large dunes are the main hazards to military operations. Profile diagram reflects soils in interdune areas and not the dunes per se. The dunes are chiefly composed of poorly graded sand (SP) and silty sand (SM). |
| 5 | 439 km² (169.5 mi²) | Gently sloping to undulating outwash plains of the intermountain basin. Covered by coppice dunes. Heights of dunes tend to be consistent in localized areas, and range from 0.75 to 2 m (2.5 to 6.5 ft). Slopes (excluding dunes) in the 0 to 2 percent range. | cm<br>SM-SC SP, CL — Loamy fine sand to fine sandy loam<br>60<br>Ca — Caliche<br>170<br>SM-SC GM — Loamy fine sand to gravelly loam<br>Depth to bedrock is >6 m (>19.5 ft) | Rapid<br>Impermeable<br>Rapid | Low<br>Low<br>Low | Strongly cemented to indurated layer occurs from 60 to 170 cm (24 to 67 in) in depth. | Severe<br>e,i | Severe<br>e, h, i | Moderate<br>h, i, l | Moderate<br>h, i, l | Moderate<br>h, i | Slight to Moderate<br>h | Major Soil Associations: Hueco-Wink and Simona-Harrisburg. The cemented to indurated caliche is a problem in construction; however, much of it is of crushing quality. Sand dunes necessitate a circuitous route which reduces the rate of advance in cross-country movement. Blowing sand is severe at times. Two areas of inclusions should be noted in the northeast portion of El Paso County. One is a small area of active sand dunes and the other an area of Wink soils with no dunes. Profile diagram reflects soils in interdune areas and not the dunes per se. The dunes are chiefly composed of poorly graded sand (SP) and silty sand (SM). |
| 6 | 393.6 km² (152 mi²) | Undulating to sloping alluvial fans and pediments adjacent to mountains and mesa escarpments. Areas generally dissected by many drainageways. Slopes generally 5 to 8 percent with a 3 to 15 percent range. | cm<br>GM to SM — Gravelly very fine sandy loam to gravelly loam<br>40<br>GP-GM SP-SM — Very gravelly sandy loam to gravelly loam<br>Depth to bedrock is >6 m (>19.5 ft) | Moderate<br>Slow to Moderate | Low<br>Low | None | Moderate to Severe<br>d,e,g,s | Moderate to Severe<br>d,e,g,s | Moderate<br>d,s | Moderate<br>d,s | Moderate<br>g | Moderate<br>d,g,s | Major Soil Associations: Nickel-Tencee, Nickel-Upton. Pinaleno-Nolam, Aladdin-Coxwell and Agustin. Complex slopes and dissection by numerous drainageways limit cross-country movement. |
| 7 | 75 km² (29 mi²) | Undulating to sloping alluvial fans and terraces adjacent to mountains and mesa escarpments which are underlain with caliche. Slopes generally 5 to 8 percent with a 3 to 15 percent range. | cm<br>GM or SM — Gravelly sandy loam<br>40<br>Ca — Caliche<br>152<br>GM-GC or SM — Gravelly loamy sand to gravelly sandy clay loam<br>Depth to bedrock is >6 m (>19.5 ft) | Moderate to Rapid<br>Impermeable<br>Moderate to Rapid | Low<br>Low<br>Low | Indurated. Occurs from 40 to 152 cm (16 to 60 in) in depth. | Severe<br>e,i,s, | Severe<br>e,i,s | Severe<br>i,s | Severe<br>d,i,s | Severe<br>g,i,s | Moderate<br>d,g,s | Major Soil Associations: Del Norte-Canutio, Tencee-Upton, Terino-Casito and Simona. Complex slopes and dissection by numerous drainageways limit cross-country movement. In many areas, the caliche is suitable for use in construction when crushed. Good sand and gravel for construction is below the caliche in most areas. This unit is similar to Unit 6, except for the presence of caliche. |

# D. ENGINEERING SOILS (Continued)

| MAP UNIT | AREA MAPPED ON RESERVATION KM² (MI²) | LANDFORM AND SLOPE | TYPICAL SOIL PROFILE[1]-LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION[2] (PROFILES NOT TO SCALE) | PERMEABILITY | SHRINK-SWELL POTENTIAL | CALICHE[3] | RATING AND MAJOR LIMITING SOIL CHARACTERISTICS FOR: SEWAGE LAGOONS | SANITARY LANDFILL | FOUNDATION FOR SMALL BUILDINGS | ROAD LOCATION | SHALLOW EXCAVATION | TRAFFICABILITY | MAJOR SOIL ASSOCIATION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 44 km² (17 mi²) | Broad, nearly level to gently sloping uplands on the Otero Mesa. Slopes generally 3 percent with a 0 to 5 percent range. | cm<br>ML or SM — Very fine sandy loam<br>8<br>SM-SC CL-ML — Loam to sandy clay loam<br>35<br>CL-ML — Silty clay loam very high in carbonates<br>78<br>GM-GC SM-SC CL-ML — Gravelly sandy clay loam to gravelly silt loam<br>Depth to bedrock is 2 to 6 m (6.5 to 19.5 ft) | Moderate<br>Moderate<br>Moderate<br>Moderate | Low<br>Moderate<br>Moderate<br>Low | None | Moderate e | Moderate e | Moderate l | Moderate l | Slight | Slight | Major Soil Association: Armesa. This soil has no severe limitations for construction or military operations. |
| 9 | 198.4 km² (76.6 mi²) | Broad, nearly level to sloping limestone controlled uplands on the Otero Mesa. Slopes generally 3 to 5 percent with a 1 to 10 percent range. | cm<br>SM,ML GM — Fine sandy loam to gravelly silt loam<br>10<br>SM-SC CL-ML GP-GM — Sandy clay loam, gravelly sandy loam to gravelly silt loam<br>45<br>Ca — Caliche<br>71<br>GP-GM — Very gravelly silt loam to cobbly silt loam<br>Depth to bedrock is 2 to 6 m (6.5 to 19.5 ft) | Moderate<br>Slow to Moderate<br>Impermeable<br>Moderate | Low<br>Low to Moderate<br>Low<br>Low | Indurated. Occurs from 45 to 71 cm (18 to 28 in) in depth. | Severe e,i | Severe e,i | Moderate i | Moderate i | Severe g,i | Slight | Major Soil Associations: Tencee, Philder and Jerag-Philder. Shallow caliche and gravelly surface soils limit use for construction and military operations. |
| 10 | 135 km² (52 mi²) | Complex of map units 8 and 9 above. Slopes generally 3 to 5 percent with a 0 to 10 percent range. | Complex of units 8 and 9, each almost equally represented | | | (see above Map Units 8 and 9) | | | | | | | Major Soil Associations: This is a complex of Philder-Armesa (see Units 8 and 9 above) mapped only on the Otero Mesa and Sacramento Mountains. Two associations of limited extent are included: the first is the Espy-Shanta Variant association mapped in the Sacramento and El Paso River valleys; the second is the Pena-Cale-Kerrick association, which exists on broad, nearly level upland valleys. |
| 11 | 448 km² (173 mi²) | Gently sloping to moderately steep rock outcrops and bedrock controlled plateaus or pediment slopes at base of mountains. Occasionally mapped as small rounded to oval shaped hills outlying the mountain ranges. Slopes generally 5 to 12 percent with a 1 to 18 percent range. | cm<br>GM-GC — Very gravelly loam to cobbly loam<br>38<br>Depth to bedrock is <0.6 m (<2 ft) | Moderate | Low | None | Severe b,s | Severe b,s | Severe b,s | Severe b,s | Severe b,g | Moderate b,s | Major Soil Associations: Lozier-Limestone rock outcrop and a portion of Rock outcrops-Argids. Depth to bedrock and gravelly soil conditions are major limitations. The western and northern sides of some outlying hillocks may be partially covered by windblown sand as much as 1.8 m (6 ft) deep. |
| 12 | 606 km² (234 mi²) | Extremely hilly to very steep igneous and limestone mountainous terrain. Slopes range from 20 percent to nearly vertical escarpments. | cm<br>GM-GC — Gravelly loam to loose gravel and cobbles<br>15<br>Depth to bedrock is <0.6 m (<2 ft) | Moderate | Low | None | Severe b,s | Severe b,s | Severe b,s | Severe b,s | Severe b,g | Moderate to Severe b,s | Major Soil Associations: Lozier-Limestone rock outcrop, Ector-Rock outcrop, Deama-Rock outcrop, Igneous rock land-Brewster, Limestone rock land-Lozier and Rock outcrops-Argids. The extremely steep slopes and the very shallow depth to bedrock limit construction, military operations, and cross-country movement in this mountainous unit. |

[1] These are "average" typical profiles based on the major soil associations; thicknesses and composition may vary considerably from those shown.

[2] The Unified Soil Classification System, Technical Memorandum No.3-357, U.S. Army Corps of Engineers, March, 1953.

[3] Caliche is a more or less cemented deposit of calcium carbonate found in many soils in the Southwestern United States. The material may consist of soft, thin layers in the soil or of hard, thick beds. Caliche is located just below the uppermost layer(s), or it may be exposed at the surface by erosion.

[4] A soil association is a landscape that has a distinctive proportional pattern of soils.

[5] Coppice dunes form on the downwind side of an obstruction such as a bush, tuft of grass, etc.

PERMEABILITY RATINGS

Slow—0.5 to 1.5 cm/hr (0.2 to 0.6 in/hr)
Moderate—1.5 to 5.0 cm/hr (0.6 to 2.0 in/hr)
Rapid—5.0 to 15.0 cm/hr (2.0 to 6.0 in/hr)

SOIL CHARACTERISTICS AFFECTING RATINGS

b—bedrock shallow, depth < 60 cm (<24 in)
d—dissected by numerous drainageways
e—excessive permeability
f—flooding
g—gravel or coarse fragments
h—hazard of blowing sand or soil
i—indurated or cemented caliche, depth < 66 cm (<26 in)
l—low bearing strength when saturated
s—slopes, steep and/or complex

DEFINITIONS OF RATING TERMS

SLIGHT—relatively free of limitations or limitations are easily overcome.
MODERATE—limitations can be overcome with good planning and/or careful design.
SEVERE—limitations are serious and are difficult to overcome.

JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 3

JOINS MAP 1

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS · ORGAN PEAK · WHITE SANDS · ORO GRANDE · PENDEJO WASH · PRATHER RANCH (Pictomap Series V7810) · LA MESA · NEWMAN · DESERT · BASSETT LAKE · FORT BLISS · HUECO TANKS

Series V781
Series V782
Inset

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

MCGREGOR GUIDED MISSILE RANGE

HUECO MOUNTAINS

TULAROSA VALLEY

FRANKLIN MOUNTAINS

NEW MEXICO
TEXAS

OTERO COUNTY
EL PASO COUNTY

FORT BLISS MILITARY RESERVATION

BIGGS FIELD

EL PASO

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING SOILS

### INTERMOUNTAIN BASIN SOILS

1. Dominantly silt soils on floodplains, playas, and broad drainageways.
2. Sandy soils overlying soft caliche on gently sloping outwash plains.
3. Fine sands on dune-covered plains.
4. Sands and silts underlain with gypsiferous lacustrine sediments; occurs on relic lake beds largely covered with dunes.
5. Dominantly sands underlain with caliche on dune topography.

### ALLUVIAL FAN SOILS

6. Gravelly soils on alluvial fans and pediment toeslopes.
7. Gravelly soils underlain with caliche; on alluvial fans dissected by many drainageways.

### PLATEAU SOILS

Does not appear on this map

8. Silts and silty sands on broad mesa uplands.
9. Shallow gravelly silts and sands underlain with caliche; occurs on broad mesa uplands.
10. Complex of Map Units 8 and 9.
11. Shallow gravelly and cobbly soils on nearly level to moderately sloping terrain.

### MOUNTAIN SOILS

12. Shallow gravelly and cobbly soils on steep terrain; much exposed bedrock.

Symbol indicates discontinuity of map units along the Texas-New Mexico state boundary due to conflicting source data. Information provided in the published Soil Survey of El Paso County, Texas, indicates a strongly cemented to indurated caliche layer in most of the soils along the state line, whereas the preliminary soil maps of Otero County, New Mexico, show this layer to be lacking.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

WHITE SANDS MISSILE RANGE

WHITE SANDS MISSILE RANGE

ORGAN MOUNTAINS

FORT BLISS MILITARY RESERVATION

DONA ANA IMPACT AREA

FORT BLISS MILITARY RESERVATION

PERSHING FIRST-STAGE IMPACT AREA
(TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

DONA ANA COUNTY
OTERO COUNTY

FORT BLISS MILITARY RESERVATION

TULAROSA VALLEY

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

JOINS MAP 3

JOINS MAP 2

JOINS MAP 1

MC GREGOR GUIDED MISSILE RANGE

MC GREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

Scale 1:50,000

CONTOUR INTERVAL 40 FEET
WITH SUPPLEMENTARY
CONTOURS AT 20 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
OROGRANDE
PENDEJO WASH
PRATHER RANCH
(Pictomap - Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782
Inset

# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING SOILS

### INTERMOUNTAIN BASIN SOILS

1. Dominantly silt soils on floodplains, playas, and broad drainageways.
2. Sandy soils overlying soft caliche on gently sloping outwash plains.
3. Fine sands on dune-covered plains.
4. Sands and silts underlain with gypsiferous lacustrine sediments; occurs on relic lake beds largely covered with dunes.
5. Dominantly sands underlain with caliche on dune topography.

### ALLUVIAL FAN SOILS

6. Gravelly soils on alluvial fans and pediment toeslopes.
7. Gravelly soils underlain with caliche; on alluvial fans dissected by many drainageways.

### PLATEAU SOILS

Does not appear on this map — 8. Silts and silty sands on broad mesa uplands.

Does not appear on this map — 9. Shallow gravelly silts and sands underlain with caliche; occurs on broad mesa uplands.

Does not appear on this map — 10. Complex of Map Units 8 and 9.

11. Shallow gravelly and cobbly soils on nearly level to moderately sloping terrain.

### MOUNTAIN SOILS

12. Shallow gravelly and cobbly soils on steep terrain; much exposed bedrock.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

PERSHING FIRST-STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

JOINS MAP 2

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

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FORT BLISS MILITARY RESERVATION

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FORT BLISS MILITARY RESERVATION

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING SOILS

### INTERMOUNTAIN BASIN SOILS

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2. Sandy soils overlying soft caliche on gently sloping outwash plains.
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### ALLUVIAL FAN SOILS

6. Gravelly soils on alluvial fans and pediment toeslopes.
7. Gravelly soils underlain with caliche; on alluvial fans dissected by many drainageways. (Does not appear on this map)

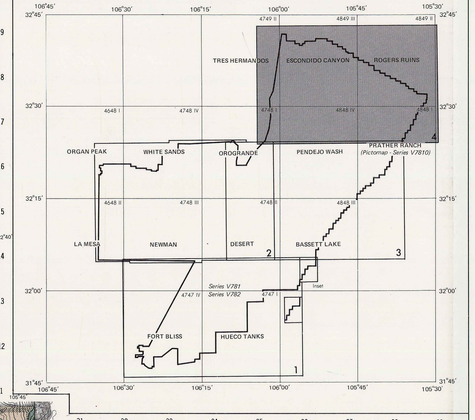
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INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




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Scale 1:50,000

1 ½ 0 1 2 3 Statute Miles
1000 500 0 1000 2000 3000 Meters

CONTOUR INTERVAL

Sheet 4748 I
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4749 II
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheet 4849 II
40 FEET

Sheets 4848 IV, 4849 III
50 FEET

LINCOLN NATIONAL FOREST
SACRAMENTO MOUNTAINS
FORT BLISS MILITARY RESERVATION
McGREGOR GUIDED MISSILE RANGE
TULAROSA VALLEY
OTERO MESA
McGREGOR GUIDED MISSILE RANGE
FORT BLISS MILITARY RESERVATION
McGREGOR GUIDED MISSILE RANGE
FORT BLISS MILITARY RESERVATION
McGREGOR GUIDED MISSILE RANGE

JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# E. ENGINEERING GEOLOGY

Fort Bliss is in the Basin and Range Physiographic Province and lies between the Mexican Highland and Sacramento Sections. The Basin and Range Province topographically consists of isolated, north-south trending mountain ranges that are roughly parallel and separated by relatively flat desert basins. Most of the reservation is within the Tularosa Basin, and extends to the edges of the Sacramento and Hueco Mountains to the east and the Franklin and Organ Mountains to the west. The Tularosa Basin and surrounding mountains lie within the Rio Grande Rift, which consists of numerous parallel, drop-faulted basins and block-faulted mountains. The rift extends from Colorado southward to Mexico, and is one of the major tectonic features of North America.

During the late Cambrian through early Pennsylvanian periods, the general area encompassing the reservation was a relatively flat, stable marine shelf. At this time beds of dolomite, shale, limestone, and sandstone were deposited. Movements of the earth's crust during the Pennsylvanian period then pushed up the areas on each side of what is now the Tularosa Basin. This crustal movement occurred in the late Pennsylvanian and early Permian periods, and was followed by the deposition of marine sandstones, siltstones, conglomerates, and limestones. A second uplift, characterized by high-angle thrust-faulting of the areas to the east and west of the basin, accompanied by down-dropping of the basin, occurred in the late Tertiary period, producing the present mountain ranges. These uplifted block mountains are tilted away from the basin with beds dipping approximately 10°. The eroded fault-line scarps that form the mountain faces on each side of the basin are a prominent geologic feature of the reservation. The basin is probably bounded structurally in most places by faults.

A prominent west-facing escarpment forms the edge of the Sacramento Mountains and the Otero Mesa, which lie along the eastern side of the reservation. On both sides of the basin a series of coalesced alluvial fans slope gently downward from the mountains toward the interior of the basin. The Tularosa Basin has moved downward due to drop-faulting, and subsequently has been filled with unconsolidated sand, gravel and clay sediments (late Tertiary and Quaternary) washed down from the surrounding mountains. Many peripheral streams that lead downward from the mountains are still filling the basin with alluvium. Basin drainage is completely internal. Flash flooding is a potential hazard in all the gullies and canyons within the reservation. The bedrock basin floor of Permian, Pennsylvanian, and Cretaceous rocks underlies unconsolidated sediments as deep as 2743 m (9000 ft) in the central portion of the basin. The depth to bedrock within the basin gradually decreases from the middle toward the edges, with bedrock exposed at the sides of the mountains.

Caliche in varying stages of development is found on the reservation over much of the southern one-third of the basin area, on the Otero Mesa, and in some of the surrounding upland slope deposits. It is formed near the surface by enrichment of the soil profile with calcium carbonate precipitated from water infiltrating downward. As calcium impregnates the layer, a soft, friable caliche is formed; with further enrichment it becomes nodular. Additional enrichment greatly reduces or stops the downward infiltration of water through the caliche. Further deposition of calcium carbonate occurs along the top of the zone in thin, laminated layers; induration of these layers follows. The uppermost caliche layer is called caprock and is hard, indurated, and may be laminated, brecciated, or consist of pisolites. Caprock represents the mature stage in the development of a caliche profile. A caprock caliche profile is a nearly impervious zone. The hard, indurated caprock caliche can be used in unstabilized base construction and as aggregate in asphaltic concrete. Although caprock caliche can be used as aggregate in portland cement concrete, at present it is not generally used for that purpose. The softer caliche can be used for construction of unsurfaced roads. Caprock caliche can be excavated with a large front-end loader, but ripping is preferable when the caliche is used as construction aggregate.

Bedrock outcrops in the rugged upland areas surrounding the basin, on the Otero Mesa, and in isolated hills which are erosion remnants. The bedrock is divided into Map Units 1 and 2. Map Unit 1, which is composed of granite, Tertiary intrusive, and pre-Cambrian crystalline rocks, offers some sources of contruction aggregates and building stone. In the past the igneous rock has generally not been used for aggregate because of the presence of more desirable limestone and generally closer sources of sand and gravel. Because the properties of the igneous rock vary greatly, a thorough study of the engineering characteristics of each potential source is required. Potential construction sites of significant extent are not present due to the steep, rugged upland terrain.

Map Unit 2 consists of Paleozoic-age sedimentary formations having a total thickness of approximately 2300 m (7545 ft). These sedimentary rocks are primarily in the Sacramento Mountains and on Otero Mesa, but also outcrop in the Hueco and Organ Mountains at intermediate elevations. Limestone and dolomite are the most commonly encountered bedrock on the reservation. The San Andres and Hueco formations have the most widely distributed limestone and dolomite beds suitable for aggregate and dimension stone. The San Andres Formation has several beds of pure, hard crystalline limestone. The Hueco Limestone is massive, has fewer contaminating shale beds than the San Andres, and is also a good potential source of building materials. The Yeso Formation locally has good limestone beds for aggregate, but often is contaminated with unsuitable limy mudstones. Good limestone and dolomite beds are also found along the cliffs of the Sacramento Mountains. These rocks are less frequently exposed and access poses a problem. The sedimentary rocks are usually almost horizontally bedded and, as a result, should generally remain stable in near vertical cuts. Numerous rockfalls and landslides are found along the steep escarpment face of the Sacramento Mountains and Otero Mesa. The general stratigraphy of these formations is shown in three cross-sections (below). The broad, gently sloping rocky limestone terrain of the Otero Mesa is well suited for the construction of airfields and multi-structure emplacements. Access to the mesa is presently limited. Moderately heavy loads can be readily supported on shallow foundations; short piers or piles to bedrock can support heavy loads. The subsurface soils are suitable for supporting heavy-duty roads and airfields. Bedrock in this area is near the surface, and suitable sand, gravel, and quarry sites are present within and along the flanks of the mesa.

The unconsolidated alluvial soils found over most of the reservation are grouped into Map Units 3 through 7. Gravels and boulders mixed with sand and silts are stacked against the mountain and escarpment faces, grading into the generally finer-grained deposits of the lower basin areas. Present construction on the reservation is essentially limited to the southwest corner, within the basin (Map Unit 3) and alluvial fan deposits (Map Unit 4), although other units are developable.

The nearly level to gently rolling surface of the Tularosa Basin (Map Unit 3) occupies most of the reservation and consists of shallow ephemeral lake beds, alluvial plains, and low sand dunes stabilized by mesquite. Some of the shallow depressions may be the result of solution activity in gypsum. The upper alluvial soils within the Tularosa Basin usually consist of loose silty and clayey sands and soft to firm silts and clays of low plasticity. These soils are erratic and discontinuous in lateral extent. The broad, flat alluvial plains within the basin are reasonably well suited for roadways, airfields, and multi-structure emplacements. At selected locations within the basin, light to moderate column loads can be supported on shallow foundations. Access to this area is good. Perched groundwater has been encountered in one deep excavation in the Tularosa Basin. Gypsum, expansive clays, and collapsing sands may be present in isolated areas. Potential sand, caliche, and some gravel pit sites are available; existing or potential quarry sites are not present.

The gentle to moderate slopes of the alluvial fans (Map Unit 4) and alluvium (Map Unit 5) also offer some reasonably good sites, usually of somewhat limited extent for multi-structure emplacements. The soils are generally capable of supporting light to moderate column loads on shallow foundations, and would provide good to excellent subgrade support for heavy-duty roadways. Present access is somewhat limited but could be developed. Sand and gravel are plentiful within these units and quarry sites are available.

The pediment slope deposits (Map Unit 6) are near the escarpments and mountain faces, generally occupying areas of intensely gullied, gently sloping terrain. The depth to bedrock is generally less that 5 m (16 ft), with bedrock exposed in some areas. The material overlying bedrock generally consists of silty gravels and gravelly sands with cobbles and boulders up to 0.6m (2 ft) or more in size, and offers a source of construction aggregates. Only very limited construction siting is available, although the subsurface soils are suitable for heavy-duty roadways and for supporting moderate column loads on shallow foundations. Access would generally be a problem in this unit.

The rockfall, talus, and colluvium slope deposits of Map Unit 7 are on moderate to steep slopes immediately below the Sacramento Mountain and Otero Mesa escarpments. This unit is not suitable as a source of aggregates nor for construction siting. It is subject to creep movements, rockfalls, and landslides.

The New Mexico State Highway Department has identified 35 potential pit or quarry sites on the reservation, as shown on the maps. Eighteen of these sites have been sampled, and the physical properties of the materials are summarized in a table below.

## DESCRIPTION OF GEOLOGIC UNITS

| MAP UNIT | TOPOGRAPHY | ROCK DESCRIPTION | PHYSICAL CONSTANTS | ENGINEERING EVALUATION | EXCAVATION FACTORS | PITS AND QUARRIES |
|---|---|---|---|---|---|---|
| 1. Granite, Tertiary intrusive igneous rocks, and pre-Cambrian crystalline rocks: well-dissected uplands. | Areas of high relief consisting of rugged, well-dissected upland terrain often bounded by steep slopes and escarpment faces.<br><br>Terrain is steep and severely dissected. Canyons generally have north-south or east-west alinements.<br><br>Occurs primarily in the Organ Mountains, but is also in the Hueco Mountains and as relatively small outcroppings near the base of the Sacramento Mountains. Small isolated exposures form the low hills just to the southwest of the Jarilla Mountains, near Orogrande Range Camp.<br><br>Local relief ranges from 30 m (100 ft) to 1180 m (3870 ft). Organ Peak, north of Soledad Canyon, has the highest elevation in this unit of 2704 m (8870 ft) at grid reference 542779. The lowest elevation of 1268 m (4160 ft) is on Rattlesnake Hill (grid reference 932820), to the southwest of the Jarilla Mountains.<br><br>The overall drainage pattern is dendritic, although definite angular trends exist due to slope control. Stream alinements are often straight. Dissection is moderate to intense and moderately spaced.<br><br>The Organ and Hueco Mountains form part of a chain of tilted fault-block mountains extending from the southern Rockies to the Rio Grande. The east side of the Organs is significantly more rugged than the west, and is composed primarily of Tertiary intrusives.<br><br>The Sacramento Mountain exposure is limited to a small portion of the pre-Cambrian basement complex underlying other significant units.<br><br>The uplands within Map Units 1 and 2 were created by the upward movement of these areas by high-angle faulting and down-dropping of the Tularosa Basin. The block-faulted mountains on each side dip away from the basin at approximately 10°. | The consolidated rocks exposed in the Organ and Hueco Mountains include dikes, sills, plugs, stocks, and laccoliths of Tertiary intrusives, monzonite, quartz monzonite, andesite, rhyolite, and granite. Minor outcroppings of pre-Cambrian granites and crystalline rocks are in the southern portion of the Organ Mountains, and in a small exposure in the northwest extremity of the Sacramento Mountains.<br><br>Jointing and faulting are common, especially in the Organ Mountains. Although not common, there is some gentle folding, primarily in the Organ Mountains.<br><br>Strike in the Organ Mountains is approximately N 15° W, and the dip about 10° to the west. In the Sacramento and Hueco Mountains, the strike varies from N 5° W to N 20° W, and the dip varies from 5° to 20° east. Unit thickness ranges from 61 m (200 ft) in the Hueco Mountains to almost 610 m (2000 ft) in the Organ Mountains.<br><br>The rhyolite and andesite are porphyritic and have a fine-grained texture with distinct large cyrstals of feldspar in a matrix of distinguishable smaller quartz and feldspar crystals. The texture of the monzonite, granites, and crystalline rocks is coarse with prominent, interlocked angular grains of quartz, feldspar, augite, hornblende, and amphibole.<br><br>These rocks are highly variable in density and hardness. Weathering proceeds fastest along faults, joints, and fractures. Quartz monzonite has weathered in this way to form the striking "needles" area in the Organ Mountains (grid reference 596782).<br><br>The rhyolite typically has a weak red or gray matrix with large white and pinkish gray crystals, and is commonly found with a black obsidian having large gray crystals and tension cracks. The andesite varies in color from gray and speckled white to green and blue. Tuff is often pale yellow with white specks. The monzonite varies in color from pinkish gray, gray speckled with black, to very dark gray speckled with white. The granites and pre-Cambrian rocks are typically light brown, gray, and red.<br><br>The rocks are Tertiary-age igneous porphyry intruded through older country rock along faults and bedding planes. | No data | Generally unsuitable for construction siting, but offers a fair potential as a source of construction materials. Because this unit is almost entirely rugged upland terrain, sites suitable for multi-structure emplacement are not available.<br><br>Nearly straight alinements for roads or railroads are limited to Soledad Canyon in the Organ Mountains.<br><br>Alinements for roadways and railroads would require excessive cut and fill, blasting, steep grades, and numerous bridges. Cuts should maintain vertical slopes because of generally near vertical jointing. Access to the edges of this unit could be gained with little to moderate difficulty, but the rugged terrain and steep slopes will make access to the interior difficult. Construction of new access routes within this area would be difficult.<br><br>The shallow bedrock can support heavy duty roadways and heavy structures. Dams would have problems of excessive seepage of water through the jointed and faulted rock foundations. Some springs are in the Organ Mountains; a flash flooding potential exists in the canyon bottoms. Some relatively minor rockfalls occur, but are limited due to near-vertical joints.<br><br>Some sources of crushed stone are available for use in portland cement concrete, asphaltic concrete, and for unstabilized aggregate bases. Because of poor access and the availability of high-quality limestone and natural gravels elsewhere, this unit has not generally been used as an aggregate source. The properties of the rock are highly variable.<br><br>No suitable sites for the disposal of liquid or solid waste materials. | Excavation of the bedrock will generally require drilling and blasting; some Tertiary rocks are probably rippable.<br><br>Overburden on side slopes and ridge and mountain tops is quite thin. Loose rock talus at the base of some slopes is a potential gravel source and can be excavated by ordinary power equipment. Talus deposits of highly variable properties may be as deep as 6 m (20 ft) or more at some locations.<br><br>Because of near-vertical joints, vertical quarry faces in bedrock should remain stable. Strength of the rock is quite variable. Rock tunneling in some Tertiary rocks may be moderately difficult; rock bolting and lining will be necessary.<br><br>In isolated areas, some local seepage problems could be encountered, especially at greater depths, because of the presence of numerous joints and faults in the rock. | Potential quarry sites are limited to the periphery of this unit due to poor internal access; variable rock properties and the presence of high quality limestone and gravels in other units limit the value of this unit for quarries. Several quarries are present (listed in a table below), and are shown on the maps. Sand and gravel pits are not present.<br><br>Because of the steep terrain and lack of access roads, existing and potential quarry sites are along the periphery of the unit at a few locations in the Organ and Hueco Mountains; suitable sites are not present in the Sacramento Mountains.<br><br>Finding quality construction rock in accessible locations will probably be difficult. One possible quarry site in rhyolite of unknown quality is on the edge of the Organ Mountains adjacent to an existing road (grid reference 544653 to 545685). Excavation should be advanced parallel to normal joint sets to produce blocks of workable size. Other possible sites are in the Tertiary intrusives in the Hueco Mountains.<br><br>Jointing at these sites also appears favorable for quarrying operations. Loose, unconsolidated gravelly alluvium gradually increases in thickness from nonexistent at the top of slopes to as much as 7 m (23 ft) at the base.<br><br>Vertical working faces should generally remain stable. Drilling should be easy to moderately difficult. Although blasting will usually be required, no unusual quarrying problems should be encountered.<br><br>Soledad Canyon Creek, an intermittent stream, offers the only source of wash water in the Organ Mountains. A suitable supply of wash water is not available in the Hueco Mountains. |

# E. ENGINEERING GEOLOGY (Continued)

| MAP UNIT | TOPOGRAPHY | ROCK DESCRIPTION | PHYSICAL CONSTANTS | ENGINEERING EVALUATION | EXCAVATION FACTORS | PITS AND QUARRIES |
|---|---|---|---|---|---|---|
| 2. Hard limestone and dolomite, inter-bedded with sandstone and shale: flat-lying Otero Mesa and slightly dipping, well-dissected uplands. | Moderately steep, well-dissected, rugged uplands, near-vertical rock faces and rocky, flat-lying Otero Mesa; unit occupies positions of intermediate elevation in the Organ and Hueco Mountains and on the Otero Mesa, and of high elevation in the Sacramento Mountains.<br><br>Severe dissection produces steep hills, narrow valleys, and almost vertical rock faces except on the Otero Mesa. Stream alinements are generally slope-controlled; alinements tend toward north-south and east-west directions.<br><br>The Sacramento Mountain escarpment rises abruptly above the Tularosa Basin, giving a maximum local relief of 869 m (2850 ft); local relief, however, in some areas is negligible. Elevations range from 1280 m (4200 ft) in the Hueco Mountains (grid reference 912313), to 2149 m (7050 ft) in the Sacramento Mountains (grid reference 205163). Overall drainage pattern is predominantly dendritic, although definite angular trends exist due to slope control. Except for the Otero Mesa, the unit is intensely dissected with angular drainage channels occupying steep, narrow valleys.<br><br>Rockfalls and landslides occur along the near vertical, west-facing escarpment of the Sacramento Mountains and Otero Mesa. These rockfalls are the source of the thick accumulations of colluvium and talus at the toe of the escarpment (Map Unit 7). Numerous west-dipping, high-angle faults in the Sacramento Mountains increase in number near the escarpment. The fault on which the uplifting of the Sacramentos occured is believed to be near the present base of the escarpment. Gentle folds occur in the higher part of the Sacramentos. Tertiary sills and dikes of intermediate composition are of local importance.<br><br>The tilted, block-faulted mountains of this unit are composed of sedimentary rocks and were created during Tertiary time. | Thick, horizontally bedded series of consolidated Paleozoic sedimentary rocks. Predominant rocks are fine-grained limestone and dolomite interbedded with sandstone and shale, and occasionally minor occurrences of gypsum. The rock types generally have conspicuous boundaries, are thin to massively bedded, hard, dense, jointed, and are frequently faulted.<br><br>Exposed thicknesses range from approximately 30 m (100 ft) in the foothills of the Hueco Mountains to more than 914 m (3000 ft) in the southern Sacramento Mountains. Strike is generally north, ranging from approximately N 10° E to N 25° W; dips vary locally from 10° E to 40° E. Folding has occurred locally, most noticeably in the vicinity of Bug Scuffle Canyon in the Sacramento Mountains.<br><br>Within the Organ Mountains, rocks are primarily dark gray to black, usually fine grained limestone and olive to dark gray, fine-grained, finely laminated shales. Small quartz veins cut the shale beds.<br><br>Generalized geologic cross sections through the eastern portion of this unit are given in Sections B-B' and C-C'. The San Andres Formation (Permian) is typically 30 m (100 ft) in thickness and consists of buff to dark gray, massive, petroliferous limestone, interbedded dolomite, and gypsum with minor sandstone beds.<br><br>The Yeso Formation (Permian) underlies the San Andres Formation and is typically 396 m (1300 ft) thick. Springs occur on the canyon sides near the contact of the two formations. The Yeso Formation consists of friable to hard, coarse-grained, thin to massive beds of sandstone; fine-grained, pink to yellow, gypsiferous shale; and dark gray, often earthy, massive bedded limestone with some gypsum beds. Rock characteristics change abruptly. Clay and silt mixed locally with gypsum form a significant part of the Yeso Formation.<br><br>The Abo Formation (Permian) consists of thin- to thick-bedded gray shales, limestones, dolomites and reddish brown mudstone, siltstone, and very fine-grained sandstones. In the Sacramento escarpment area, the upper rock is frequently a fine-grained sandstone and/or coarse siltstone, usually having an ankeritic cement with small holes and mud cracks. The red-bed deposits have been mined sporadically for lead. The thickness of this formation is approximately 122 m (400 ft).<br><br>The Gobbler Formation (Pennsylvanian) is composed of well sorted quartz sandstone, dark gray cherty limestone, and shales; thickness is about 27 m (1400 ft). The quartz sandstone and dark limestones in the lower 61 to 152 m (200 to 500 ft) of the formation are resistant to erosion and often form prominent ledges. The Hueco Limestone (Permian) is a massive, gray, fossiliferous limestone with local beds of shale and limestone. | **Permeability:** A relatively impermeable layer is reported near the top of the Yeso Formation, causing lateral flow of water along this contact; springs on canyon sides occur at the contact with the San Andres Formation.<br><br>**Potential Aggregate Sources:** Physical properties of material obtained from potential pit and quarry sites are summarized in a table below. | Good sites for multi-structure emplacements, airfields and other facilities are available on the Otero Mesa; high quality rock for construction aggregates, dimension stone, and other uses is also available.<br><br>The Otero Mesa is a broad, flat to gently rolling, rocky limestone plain. Airfield sites are available north of El Paso Draw (grid reference 360876) and in the vicinity of Mare Pasture Tub (grid reference 230790). Numerous multi-structure emplacement sites are available, for example at Prather Ranch (grid reference 421878). Locations south of Route NM 506 are generally more suitable than those to the north.<br><br>Access is available along a road east from Route US 54 at Paxton Siding through a break in the escarpment onto the Otero Mesa. Access is also available from the south via the Dell City Cutoff Road.<br><br>New road alinements on the Otero Mesa would not generally be restricted by topography or subsurface conditions, and would be relatively straight. Grades would be gentle, with fill and drainage structures limited primarily to relatively infrequent stream channels. In the upland areas, access is limited and new road alinements should follow the short canyons where possible. Road alinements in the uplands (other than in canyons) would involve steep grades, sinuous alinements, numerous drainage structures, rock blasting, and large quantities of cut and fill. Because of near vertical joints, vertical rock slopes should generally remain stable, except where bedding planes dip into the cut.<br><br>Existing light duty roads on the Otero Mesa cross the natural drainageways. In the uplands, short, relatively straight existing road segments are limited to the canyon bottoms, including Culp, Grapevine, El Paso, Sacramento River, and West McAfee Canyons.<br><br>The granular soils underlying the Otero Mesa are good to excellent for subgrades, and are capable of supporting heavy duty roads and airfields. In most areas, buildings having light to moderate loads can be supported on shallow foundations. Heavy foundation loads can be readily supported by moderate capacity piers or piles carried down to bedrock (which is generally less than 6 m (20 ft) deep). Foundations excavated in shales should be poured as soon as possible to prevent softening. Excessive leakage under dams through sands and gravel on Otero Mesa could be a problem; an impermeable cutoff to bedrock or an impermeable upstream blanket may be required. Clays are scarce for use in dam cores, cutoffs and impermeable blankets. Structures and roadways should not be placed immediately adjacent to the escarpment because of potential rockfall and landslide problems.<br><br>Sand and gravel are available on the Otero Mesa and on the eastern edges of this map unit. The Bliss sandstone and many of the limestone beds are suitable for use as aggregates for portland cement concrete, asphaltic concrete, base courses, rip-rap, and rock fill. Some of the limestones are suitable for use as building, dimension, and ornamental stone, although access might be a problem. The raw ingredients for manufacturing portland cement are available.<br><br>Suitable sites exist for the disposal of some types of solid wastes; disposal of liquid wastes might result in groundwater pollution. | Excavation of bedrock will generally require drilling and blasting; ripping of some rock may be possible. Considerable silt and clay in the Yeso Formation can be excavated with ordinary earth-moving equipment or by hand. Numerous sites with reasonably good access are available. Residual and colluvium overburden is generally less than 0.6 m (2 ft) thick.<br><br>Springs on canyon sides at the contact between the Yeso and San Andres Formations are relatively common and could cause problems in excavations. Because of near-vertical joints, vertical quarry faces in bedrock should remain stable. Numerous faults are present, particularly near the escarpment face. Rockfalls and landslides are present along the top edge of the escarpment. Mixed-face tunneling may be required in the Yeso Formation where clay and silt are common. Seepage problems may occur in the lower portion of the San Andres Formation or locally in deep excavations or tunnels because of the presence of numerous joints and faults. Tunnel lining may not be required in the hard, massive limestones and dolomites of the San Andres, Hueco, and Yeso Formations; some rock bolting will be necessary. | Numerous potential pit and quarry sites having reasonably good access are available. Fifteen potential pit and quarry site locations in this unit are shown on the maps. Physical properties of materials encountered at eight sites are summarized in a table below. Limestone and dolomite are most commonly encountered in this unit. The best limestone and dolomite beds are in the San Andres and Hueco Formations. Locally, the Yeso Formation has good beds but is often contaminated with limy mudstones.<br><br>Overburden at favorable sites is usually less than 0.6 m (2 ft) thick. Drilling and blasting is generally required; the hard, dense limestone will have slow drilling rates. Some shales and weathered rock may be rippable with a D-9 dozer. Because of almost vertical joints, excavations made with vertical slopes should remain stable. In general, seepage should not be a problem; refer to Excavation Factors for a discussion of potential seepage problems. Wash water is not available. |

# E. ENGINEERING GEOLOGY (Continued)

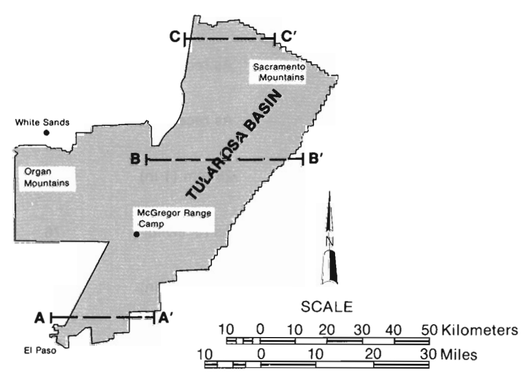
| MAP UNIT | TOPOGRAPHY | ROCK DESCRIPTION | PHYSICAL CONSTANTS | ENGINEERING EVALUATION | EXCAVATION FACTORS | PITS AND QUARRIES |
|---|---|---|---|---|---|---|
| 3. Basin deposits: flat to gently rolling, deep basin alluvium. | Low sand dunes, old lake beds, and alluvial plains which form the nearly level and occasionally gently rolling surface of the Tularosa Basin. The basin deposits occupy the lowest position in the landscape, and are generally bounded by the gentle alluvial fan and alluvium slopes.<br><br>The area is relatively flat to gently rolling with the typical relief being approximately 12 m (40 ft) with a maximum of 100 m (330 ft) above contiguous areas. Elevations range from 1280 m (4200 ft) adjacent to the Hueco Mountains (grid reference 931337) to 1180 m (3870 ft) in the cantonment area (grid reference 652210).<br><br>Drainage is entirely internal with no streams leading away from the basin. Numerous wind-excavated shallow depressions typically 6 m (20 ft) in depth are throughout the basin. Some shallow depressions may be related to solution activity in gypsum. Relatively short, poorly developed drainage channels extend downward from the alluvial fan deposits (Map Unit 4) and terminate in the shallow depressions and five emphemeral lakes along the east and west periphery of the basin. These depressions present a temporary flooding hazard after cloudbursts.<br><br>Much of this unit is covered with low sand dunes generally less than 3 m (10 ft) in height. Mesquite on the dunes stabilizes them. When disturbed by vehicles, blowing sand, silt and dust constitute a hazard to personnel and equipment throughout the year; during periods of high winds a problem exists even if not disturbed.<br><br>The deep basin deposits were formed from late Tertiary time to the present by reworking into the downfaulted basin unconsolidated fluvial deposits originally at higher elevations. | Generally consists of loose to firm silty sands, clayey sands, and soft to firm silts and clays of low plasticity. The sand dunes usually have a thin cover typically 20 cm (8 in) thick of poorly graded, fine sands, and silty fine sands. The basin soils are highly erratic; old lake bottom deposits may occur beneath sand dune or alluvial plain soils. The sand size particles are composed primarily of quartz, feldspar, calcite, and gypsum. A generalized geologic cross section through the southern portion of the basin is in Section A-A'.<br><br>In approximately the southern one-third of the basin within the reservation, a white, hard, indurated caliche layer approximately 1 to 2 m (3 to 7 ft) in thickness locally occurs about 0.6 m (2 ft) beneath the surface. Beneath the hard caprock layer, the caliche becomes softer with increasing depth. Overlying the caliche are brown and yellow brown, calcareous, moderately alkaline, poorly graded sands, silty sands, and clayey sands. Mixed alluvial soils occur beneath the caliche.<br><br>The unconsolidated basin soils are very thick, typically ranging from 152 m (500 ft) on the eastern side at an oil and gas test well (grid reference 049039) just to the north of Paxton Siding, to a maximum of approximately 2743 m (9000 ft) near the base of the Franklin Mountains adjacent to the cantonment area.<br><br>The basin soils are of fluvial, lacustrine and eolian origin. More silt and clay is present than on the slopes surrounding the basin where the more coarse-grained materials have been deposited. Primary sources of basin soils are the alluvial fans and surrounding mountains. | Physical constants for two samples were taken on the southwest corner of the reservation (grid reference 638199)<br>**Sample A:** Surface to 1 m (3 ft)<br>**Classification (Unified System):** Silty sand/clayey sand (SM-SC)<br>**Gradation:** Sieve-Size % Passing: No. 4 100; No. 10 100; No. 40 87; No. 200 28<br>**Liquid Limit:** 20<br>**Plasticity Index:** 4<br>**Permeability:** 1.41 x $10^{-3}$ cm/sec (0.05 x $10^{-3}$ ft/sec) to 4.4 x $10^{-3}$ cm/sec (0.14 x $10^{-3}$ ft/sec)<br>**Shrink-Swell Potential:** Low<br><br>**Sample B:** 31.1 to 31.4 m (102 to 103 ft)<br>**Classification (Unified System):** Silty sand (SM)<br>**Gradation:** Sieve Size % Passing: ½ 100; No. 4 99; No. 10 99; No. 20 98; No. 40 94; No. 100 44; No. 200 21<br>**Moisture Content:** 10.7%<br>**Maximum Dry Density at Optimum Moisture Content:** 1.65 g/cm³ (102.8 lb/ft³) at 11.6% Moisture Content<br>**Permeability:** 1.53 x $10^{-4}$ cm/sec (0.05 x $10^{-4}$ ft/sec)<br>**Shrink-Swell Potential:** Low<br>**Source:** Fort Worth District Office, U.S. Army Corps of Engineers Boring No. 8A2C-81A<br>**Potential Gravel and Caliche Sources:** Physical properties of material obtained from potential pit sites are summarized in a table below. | The flat alluvial plains of this unit are fair to excellent for construction purposes and offer some of the best sites on the reservation. The broad, flat alluvial areas are suitable for multi-structure emplacement; ephemeral lake bottoms and depressions should be avoided because of a flooding hazard and the presence of soft clays and clayey sands.<br><br>Good alinements requiring minimal quantities of cut and fill are available for highways, railroads, and airfields. Gentle grades are possible and few drainage structures are required. Cut and fill slopes should generally be constructed at 40 percent or less. Access routes are available to potential construction sites. New routes could be readily constructed.<br><br>The subsurface soils in the alluvial plains and dune areas are generally capable of supporting light to moderately heavy column loads on shallow foundations. Because of the presence of soft clays in some areas, careful site selection is required to avoid settlement problems. Heavily loaded structures would have to be supported on friction piles. Locally perched ground water may be encountered in deep excavations (see Excavation Factors). Some of the depressions in this area may have been formed by solution of gypsum deposits. Some expansive clays and collapsing sands may be present in highly localized areas.<br><br>The subsurface soils will generally provide fair to good subgrade support for heavy-duty roads and medium duty airfields, except where old lake bottom sediments are encountered. Suitable dam sites should be available; in local areas excessive seepage through sands might be a problem. Clays suitable for use as impermeable cores and membranes are available.<br><br>The sand dunes are generally stabilized with mesquite; the present rate of movement is very slow and should not present a serious problem. Blowing sand, silt, and dust constitute a problem to personnel and equipment.<br><br>The hard, indurated caliche caprock found in portions of the southern one-third of this unit is a potential source of crushed aggregate for use in portland cement concrete, asphaltic concrete, and base courses. Each deposit should be evaluated separately because of the highly variable porperties of caliche. Caliche makes good sub-grade, and the softer caliche can be used without stabilization for surfacings of light-duty roads. Caliche can be used as structural fill. Gypsum should be avoided for structural fill; when used, good moisture content control is required.<br><br>Some sand and gravel deposits are also available, but are not nearly as numerous as in surrounding uplands. Locally available sand and gravel is usually used for aggregate rather than quarried rock because of the shorter haul distances. Soils are available for fill and dam construction. Silty and clayey soils can be compacted with a sheepsfoot roller; a vibratory roller can be used on the clean sands and gravels. The silty sands can be stabilized with portland cement.<br><br>Sites are available for the disposal of liquid and solid wastes. | The soils can be readily excavated by hand or using normal earthmoving equipment. The indurated, hard caliche caprock will require breaking with a dozer blade, front-end loader, or ripper. Access is available to dump sites throughout this unit. Overburden above the sand, gravel, and caliche deposits is thin, usually less than 1 m (3 ft) thick.<br><br>Deep excavations may encounter perched ground water. During construction of underground guided missile silos during 1973 (grid reference 654194), small quantities of perched ground water were encountered in intermittent strata within 6 m (20 ft) of grade. Most water drained rapidly from these strata with 57 liters per minute (15 gallons per minute) continuously removed during construction. Sheet piling was required to prevent collapse of the excavation. Ground water was encountered at a depth of 17 m (55 ft) below grade.<br><br>Cut slopes should generally be excavated not steeper than 40 percent. Vertical excavations greater than 2 m (6 ft) in depth require bracing. Because of the variable soil conditions and local perched ground water, tunneling in some areas might be moderately difficult. Tunnel support is required. | Potential sand and caliche pit sites are available and active pits are present.<br><br>Access roads are presently available near potential sites, and new roads could be readily developed. Overburden at potential sand, gravel, and caliche pit locations should be generally less than 1 m (3 ft) thick. Pit development probably easy and access to working faces good. Pit slopes in sands or gravels should be no steeper than 40 percent. Caliche pit slopes should be no steeper than 100 percent. Perched ground water and seepage might be a problem in deep excavations. The hard, indurated caliche is a potential source of crushed aggregate for use in portland cement concrete, asphaltic concrete, and base courses. Removal of caprock caliche by ripping is preferable when it is used for construction aggregate. Because of the large variability in hardness of the caliche, a thorough study of the engineering properties of each caliche deposit is required.<br><br>Existing and potential pit sites and physical properties of material encountered in testing are shown on the maps and in tables below. Wash water is not available. |
| 4. Alluvial fan deposits: moderately sloping, gravelly slope deposits with boulders. | Alluvial fans and coalesced alluvial fans have generally moderate slopes (5% to 20%) extending from the upland fronts and escarpment faces downward to the Tularosa Basin and Otero Mesa. These slopes have numerous gullies, and are often bounded on the upslope side by steeply sloped hillsides and escarpments. The unit occupies an intermediate position in the landscape.<br><br>Local relief ranges from as low as 10 m (33 ft) along the sides of small canyons, to 183 m (600 ft) in the vicinity of Grapevine and Bug Scuffle Canyons. Elevations range from 1280 m (4200 ft) in the vicinity of grid reference 166154 to 1463 m (4800 ft) in the vicinity of grid reference 215109.<br><br>Large ephemeral stream channels are widely spaced; stream channels are wide and shallow. Numerous small, shallow, V-shaped erosion gullies are between the larger stream channels. Ephemeral stream drainage pattern is radial; occasionally wider stream channels are braided at lower elevations, such as in Grapevine Canyon. Drainage courses lead into Map Units 3 or 5. Channel alinements are generally relatively straight due to slope control.<br><br>Alluvial fans and alluvial slopes develop adjacent to uplands and escarpments where stream gradients flatten abruptly as they come out of the uplands. As the stream gradient gradually decreases, gravels and gravelly sands are deposited first at higher elevations, and finer gravelly sands and sandy silts deposited at lower elevations in areas having relatively flat gradients. | The alluvial fan deposits consist of poorly sorted stream-deposited alluvium from the adjacent upland and escarpment areas.<br><br>Tan to light brown gravelly sands and sandy gravels with numerous angular to subrounded cobbles and boulders occur on the steeper alluvial fan slopes leading from the uplands. The alluvial deposits tend to grade near the toe of the fans to light brown silty sands and sandy silts with gravel.<br><br>Alluvial fan deposits are relatively thin at the escarpment faces and toes and generally greater than 15 m (50 ft) thick in the middle of the slopes.<br><br>The alluvial fan soils are unconsolidated, poorly sorted, and generally vary from loose to firm. Gravels in the Sacramento Mountain alluvial fans are as large as 250 mm (10 in); in the Organ Mountains gravels are up to 75 mm (3 in) in size.<br><br>In fans adjacent to the Sacramento and Hueco Mountains, the cobbles and boulders are composed of limestone, dolomite, sandstone, and rhyolite. The gravels and sands are usually composed of limestone, dolomite, chert, and gypsum. White, strongly cemented, fractured caliche layers of variable total thickness are found in some areas (refer to the Engineering Soils Maps). Total caliche layer thickness is typically 0.6 m (2 ft), with individual strata generally about 150 mm (6 in) thick. The caliche is as close as 150 mm (6 in) to the surface and has numerous fine roots at the wavy, abrupt lower boundary. The overlying sandy soils are calcareous and moderately alkaline and are coated with caliche.<br><br>Cobbles and boulders composed of rhyolite or similar granitic porphyries are in fans adjacent to the Organ Mountains. Gravel and sands are composed primarily of quartz and feldspar, with some augite, biotite, and hornblende. | **Sample location:** Middle of alluvial fan in southwest corner of reservation (grid reference 625214)<br>**Classification (United System):** Silty sandy gravel (GM)<br>**Gradation:** Sieve Size % Passing: No. 4 46; No. 10 29; No. 40 21; No. 200 16<br>**Liquid Limit:** 22<br>**Plasticity Index of Fines:** 6<br>**Permeability:** 1.41 x $10^{-3}$ cm/sec (0.05 x $10^{-3}$ ft/sec) to 4.44 x $10^{-3}$ cm/sec (0.15 x $10^{-3}$ ft/sec)<br>**Shrink-Swell Potential:** Low<br>**Moisture Content:** 3.0%<br>**Source:** Fort Worth District Office, U.S. Army Corps of Engineers Boring No. 8ASS-91.<br>**Potential Gravel Sources:** Physical properties of material obtained from two potential gravel pit sites are summarized in a table below. | The alluvial fan and alluvial slope deposits offer poor to fair sites for construction purposes. The lower half of this unit consists of areas of gently sloping, often intensely gullied terrain in which multi-structure emplacements could be constructed. Good sites are along the base of the Sacramento Mountains near Bug Scuffle Canyon at grid references 169149, 194123, and 204090.<br><br>Alinements for roads and railroads could have light grades and smooth, gentle curves. Quantities of cut and fill required would generally be moderate. Filling of numerous gullies would be required. Potential airfield sites are restricted to the northern section of McGregor Range where short, straight runways could be constructed with minimal amounts of cut and fill. Cut and fill slopes should be no greater than 40 percent. Numerous generally small drainage structures would be required to handle the ephemeral stream flow and rainfall runoff.<br><br>Some existing access routes which could be upgraded lead into this area. New access routes to potential construction sites could be readily developed.<br><br>The alluvial fan deposits are capable of supporting moderate to heavy column loads on shallow foundations. Because of the presence of gravelly soils, settlement in general should not be a problem. Due to the presence of small to large boulders, problems could be encountered in driving piles. The fan deposits are stable and creep movement would not be a problem. Flash flooding is a hazard.<br><br>The gravelly sands and sandy gravels would provide excellent subgrade support for heavy-duty roadways. Select natural sandy gravel and crushed gravel would make good to excellent base or subbase material, and are suitable for cement stabilization. These granular soils would make excellent structural fill, and can be readily compacted to high densities using pneumatic-tired or vibratory rollers. The alluvium is suitable for use in the shell of earth dams; suitable impermeable core material may be hard to locate in some areas. Excessive seepage beneath dams might occur through the gravel deposits; an impervious upstream blanket would reduce this seepage but might not be adequate.<br><br>Gravels suitable for crushing for use in asphaltic concrete, portland cement concrete, and for base courses are plentiful. Some of the hard caprock caliche is also probably suitable for use as construction aggregate.<br><br>Because of their relatively high permeability and great depth, these gravelly soils are not suitable for the disposal of solid or liquid wastes. | The gravels in this unit can generally be excavated using normal earthmoving equipment. Easy equipment access is available. Disposal sites are generally less than 1 km (0.6 mi) distant.<br><br>The gravels can be excavated with varying difficulty by hand, but large cobbles and boulders would be hard to remove in this manner. If conventional earthmoving equipment is used, large boulders would have to be selectively removed using a dozer or power shovel. Excavation slopes should not be steeper than 40 percent to remain stable. The indurated caprock caliche is layered, fractured, and often nodular; it can be readily broken up using a large front-end loader, dozer blade, or ripper.<br><br>Ground water seepage and soil creep will not be a problem. Trenches and tunneling require full support. | Some small sand and gravel pits have been developed (see table below), and numerous additional sites for sand and gravel pits are available. Pits can be readily opened near existing roadways at many sites. Two potential new sites are shown on the maps; physical properties of the materials are in a table below. Quarry sites are not present.<br><br>Overburden is usually less than 1 m (3 ft) thick. Pit slopes should not be greater than 40 percent to remain stable. Seepage and ground water probably will not cause problems.<br><br>The hard, well cemented caprock caliche in parts of this unit is a potential source of crushed aggregate. A thorough study of the engineering properties of each deposit is required because of the high variability of caliche.<br><br>Screening of the gravel is feasible because the natural water content is low. A limited water supply for washing is available only from Soledad Canyon Creek, an intermittent stream. |

# E. ENGINEERING GEOLOGY (Continued)

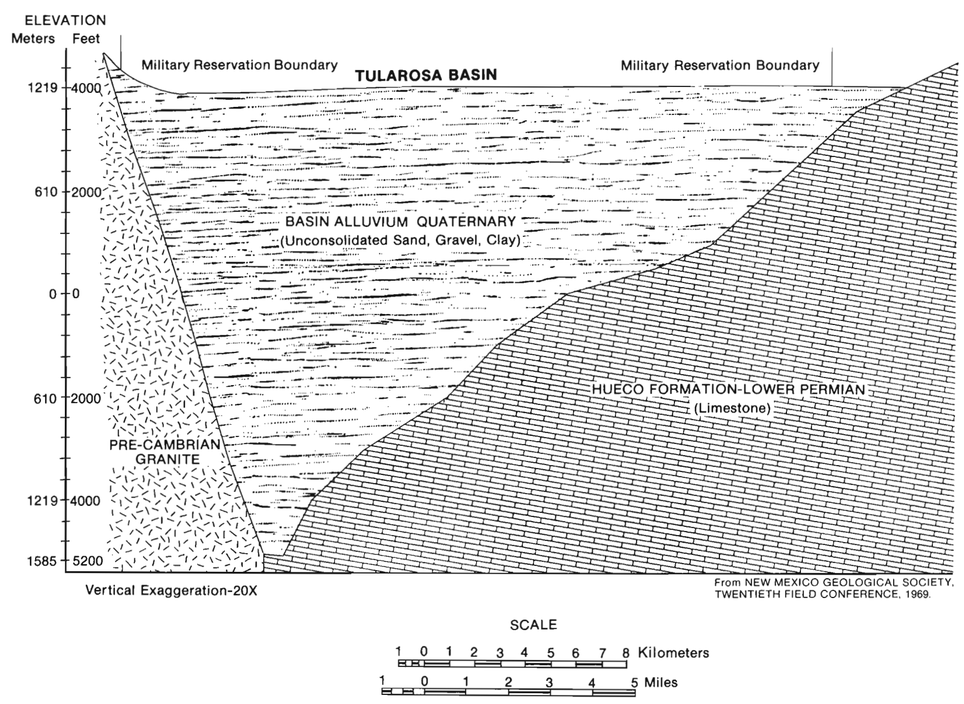
| MAP UNIT | TOPOGRAPHY | ROCK DESCRIPTION | PHYSICAL CONSTANTS | ENGINEERING EVALUATION | EXCAVATION FACTORS | PITS AND QUARRIES |
|---|---|---|---|---|---|---|
| 5. Alluvium: granular stream and slope deposits. | Alluvial deposits form gently to moderately sloping alluvial valleys and the lower slopes of the Hueco and Sacramento Mountains.<br><br>This unit occupies a low to moderate position in the landscape. Terrain includes numerous relatively broad plains, terraces, and gently sloping areas which show little dissection. Narrow valleys and canyon bottoms are also present.<br><br>The valleys tend to be straight and irregularly spaced, without a preferred orientation. The Quarternary deposits in the Hueco Mountain dipslopes are irregular, and are nearly level to gently sloping. Local relief ranges from nearly level to about 244 m (800 ft) along the Sacramento Mountains.<br><br>Elevations range from 1280 m (4200 ft) near the McGregor Range missile launcher sites at grid reference 952518 to 1524 m (5000 ft) at grid reference 051433.<br><br>An absence of drainage gullies is an important feature of the flat plains and gentle slopes of this unit. Drainage pattern of valleys is linear to dendritic. Dissection is poorly developed, and the ephemeral streams are generally widely spaced. Stream alinements are relatively straight, with a tendency toward angularity in the pattern due to slope control.<br><br>Although flash flooding is not a problem on the flat plains and gentle slopes, rapid flooding can occur in the narrow valleys and canyon bottoms.<br><br>The alluvium was formed as a result of the gradual reworking through stream action of the coarser alluvial fan deposits at higher elevations. | The materials of this unit are generally similar, but usually somewhat finer-grained than those of Unit 4, and consist of tan to light brown silty sands having varying amounts of gravel and gravelly sands with silt. This material is unconsolidated, generally with loose to very firm consistencies, and frequently calcareous and slightly alkaline. Relatively clean, subangular sands are in the stream channels, which are sometimes braided.<br><br>Low valley floors and gently sloping areas are frequently underlain by a layer of soft to indurated caliche. Where caliche is present, the upper sandy layer is typically 1 to 2 m (3 to 6 ft) thick. The underlying caliche layer is usually 0.2 to 0.6 m (0.7 to 2 ft) thick. For a description of the indurated caliche layer, refer to Map Unit 4. The caliche stratum is generally underlain by unconsolidated sand and gravel deposits. Total unit thickness is generally underlain by unconsolidated sand and gravel deposits. Total unit thickness is generally greater than 20 m (65 ft). In the McGregor Range area, silty and gravelly sands are composed primarily of calcite, with some quartz and feldspar. In the Dona Ana Range area, mineralogy is chiefly quartz and feldspar, with minor amounts of augite, biotite, hornblende, and calcite.<br><br>This unit is of fluvial origin. Sources of deposits are the fan slopes and uplands. | **Sample Location:** grid reference 003320<br>**Classification (Unified System):** Silty sand with gravel (SM)<br>**Gradation:** Sieve Size % Passing<br>No. 4 55-85<br>No. 10 40-70<br>No. 40 35-65<br>No. 200 30-50<br>**Liquid Limit:** 25<br>**Plasticity Index of Fines:** 6<br>**Permeability:** $4.44 \times 10^{-4}$ cm/sec ($0.15 \times 10^{-4}$ ft/sec) to $1.41 \times 10^{-3}$ cm/sec ($0.05 \times 10^{-3}$ ft/sec)<br>**Shrink-Swell Potential:** Low<br>**Source:** Soil Survey, El Paso County Texas, Soil Conservation Service (1971) | Alluvial deposits, although limited in extent, are generally suitable for engineering purposes. Much of the gently sloping, open terrain offers good sites for multi-structure emplacement; the narrow restricted valley areas are subject to flash flooding and are not suitable for most types of construction.<br><br>Straight alinements are available for roads and railroads located in flat plains and terraces. Flat grades are possible with small quantities of cut and fill. Cut and fill slopes should generally be no steeper than 40 percent. Relatively few drainage structures would be required to carry the ephemeral stream flows.<br><br>Several access roads lead into the general area. New roads to potential construction sites could be easily developed. The alluvial deposits are generally capable of supporting light to moderate column loads on shallow foundations. Shallow foundations placed on the cohesionless sand and gravel deposits should not experience unusual settlement problems. Settlement could be a potential problem in some of the more silty and clayey deposits. Expansive clays are probably not present. Collapsible sand could occur locally. In some areas shallow excavations may encounter a caliche layer.<br><br>Refer to Unit 4 for a general discussion of the use of sand and gravel deposits of this unit as structural fill, in earth dam construction, and as aggregate. The materials of this unit tend to be finer-grained than those of Unit 4. The finer materials should therefore be more suitable for use as impermeable cores, blankets, and foundations for dam construction. Excessive seepage through or under dams constructed in many of the materials in this unit could be a problem.<br><br>Because of their generally moderate to high permeability and great depth, materials of this unit generally not suitable for the disposal of solid or liquid wastes. | Excavation is easy by hand or by using normal earthmoving equipment.<br><br>Indurated caliche can be readily removed using a front-end loader, dozer blade or ripper; softer caliche beneath the caprock can be easily excavated with power equipment.<br><br>The materials are generally similar to those encountered in Unit 4, differing only in that large boulders usually are not present; refer to Unit 4 for a more detailed discussion. | No developed pits or quarries. Clean sand deposits of limited quantity are in several stream channels, such as in Grapevine and Culp Canyons, and some potential sand and gravel pit sites are present although not as abundant as in Map Unit 2. These pit sites are listed in tables below. For a general discussion of sand and gravel pits refer to Map Unit 4. |
| 6. Pediment slope deposits: intensely gullied, gently sloping gravel-covered rock slopes. | Intensely gullied, gently sloping, silty gravel and gravelly sand-covered rock pediment slopes of the Sacramento, Organ and Hueco Mountains. The pediment slopes form part of the gradual transition from the steep face of the uplands to the Tularosa Basin below. The terrain is severely dissected; shallow, closely spaced, straight erosion gullies extend toward the basin from the steeper slopes above. A few erosion gullies are partially filled with boulders approximately 0.6 m (2 ft) in diameter that have been washed down the slope. Occasional bedrock outcroppings of Unit 2 occur primarily in the McGregor Range area.<br><br>Local relief ranges from 6 m (20 ft) to approximately 333 m (1100 ft) along the Sacramento and Organ Mountains. Elevations range from approximately 1280 m (4200 ft) on the lower part of the slope at grid reference 140975 to 1646 m (5400 ft) at grid reference 256014 in the pediment slopes of the Sacramento Mountains; similar extremes in elevation occur in the Organ Mountains. The drainage pattern is radial to linear and stream alinements are straight. Ephemeral stream spacing is coarse with numerous small gullies between these streams.<br><br>Ephemeral stream channels and erosion gullies are subject to flash flooding. Pediment rock slopes covered with gravel deposits commonly occur and represent relic foothills of the adjacent mountains. | Unconsolidated, light to red brown silty gravels and gravelly sands with cobbles. Depth to bedrock is typically 0.3 to 5 m (1 to 16 ft), but in some areas bedrock is exposed. The deposits vary from loose to dense, and are laterally discontinuous. Caliche is generally not present. The pediment slopes are typically inclined toward the basin from 3 to 10 degrees.<br><br>In the Sacramento and Hueco Mountains, the cobbles and gravel are composed mostly of limestone, sandstone, and quartz with some chert, dolomite, and shale. Small amounts of gypsum sands are sometimes present.<br><br>In the Organ Mountains, the cobbles and gravel are composed of granite, andesite, rhyolite, or similar porphyries. The smaller sized gravels and the sands are typically composed of quartz, feldspar, augite, biotite, and minor amounts of hornblende. The gravel deposits are fluvial in origin. | **Gradation:** Sieve Size % Passing<br>No. 4 20-50<br>No. 10 20-50<br>No. 40 20-40<br>No. 200 15-35<br>**Permeability:** $4.0 \times 10^{-4}$ cm/sec ($0.13 \times 10^{-4}$ ft/sec) to $1.4 \times 10^{-3}$ cm/sec ($0.05 \times 10^{-3}$ ft/sec)<br>**Shrink-Swell Potential:** None to very low<br>**Source:** Soil survey, El Paso County Texas, Soil Conservation Service (1971) | Because of severe gullying and shallow depth to bedrock, the pediment slopes are generally not suitable for most construction purposes. The area in the McGregor Range to the north of Wright Tank, although of somewhat limited extent, is not intensely gullied and is suitable for multi-structure emplacement. Access to the south of this area is available from Paxton Siding on Route NM 506. A short access road into the area would pose no unusual problems.<br><br>At lower elevations relatively straight alinements are available for highways, railroads, and airfields. Moderate quantities of cut and fill would generally be necessary, and numerous small drainage structures would be required. At higher elevations near the mountains, steep grades would be necessary. Because of the shallow depth to bedrock in moderate cuts, rock blasting would be required in some areas. Cut and fill slopes should be no steeper than 40 percent.<br><br>Heavy to very heavy structures could be readily supported by either shallow foundations directly on bedrock or by moderately loaded short piers to bedrock. The silty gravels and gravelly sands would make good to excellent structural fill and subgrades; the quantities available are limited in some areas. Sands and gravels suitable for use in asphaltic concrete and portland cement concrete are present in somewhat limited quantities. Some of the natural sands and gravels are suitable for use as bases and subbases. The granular materials are generally suitable for stabilization with portland cement.<br><br>The granular soils could be used for fill in the shell of earth dams. Some finer-grained soils may be suitable for use as impermeable cores. Seepage beneath dams could be a problem.<br><br>This unit might be used for the disposal of some solid wastes; it would not generally be suitable for the disposal of liquid wastes. | Excavation of bedrock often found at shallow depths will generally require drilling and blasting. Conventional earthmoving equipment can be used in the relatively thin overburden. Because of intense gullying, access to most areas would be difficult. Bedrock is generally overlain by fluvial gravelly silts and silty gravels with cobbles. Overburden is relatively thin and typically varies from 0.3 m to 5 m (1 to 16 ft), with bedrock exposed in some areas. Underlying bedrock will generally require drilling and blasting. Because of almost vertical joints, steep quarry faces should remain stable. Ripping of bedrock generally will not be effective. Rock tunneling should pose no unusual problems (refer to Unit 2). Some tunnel support will be required, and a small to moderate amount of rock bolting will be necessary. Excavation faces in the gravelly overburden should be made no steeper than 40 percent. Ground water generally will not be a problem. At greater depths, some local seepage problems could be encountered because of the presence of numerous joints and faults in some areas. | Limited potential sand and gravel pit and quarry sites are available (see tables below); access is generally restricted because of intense gullying. Refer to the discussion of quarrying given in Units 1 and 2, and of sand and gravel pits given in Unit 4. |
| 7. Rockfall, talus and colluvial slope deposits: steep boulder slopes adjacent to escarpments. | Moderate to very steep slopes along the base of the near-vertical escarpments of the Otero Mesa and the Sacramento Mountains.<br><br>Local relief is typically 40 m (130 ft), with a maximum of 91 m (300 ft) to the north of Culp Canyon in the Sacramento Mountains. Elevation ranges from a low of 1448 m (4750 ft) at the base of the Otero Mesa escarpment (grid reference 172883) to 2134 m (7000 ft) on the slope of Jake's Ridge in the Sacramento Mountains (grid reference 204162).<br><br>Surface drainage is largely undeveloped; where present it is parallel due to steep slope control. | Heterogeneous deposits of unconsolidated blocky talus rock, boulders, and cobbles, which may be randomly mixed with gravel, sand, and silt. The deposit is thickest in the middle, thinning out at the top and bottom of the slope. Thickness in the deepest areas is typically 15 m (50 ft) with maximum depths as great as 40 m (130 ft). Texture of the colluvial and talus deposits is fragmental; unsorted angular particles range from silt size to greater than 3 m (10 ft) in size. These slope deposits are generally loose and frequently are in an unstable condition. Large particles are composed of angular segments of limestone, dolomite, shale, and sandstone.<br><br>The escarpment slopes are characteristic of rockfall and landslide debris and are usually unstable and subject to creep movement. | No data | The rockfall, talus, and colluvial deposits are unsuitable for construction purposes because of the unstable nature of rockfall and landslide debris. Suitable sites are not available for multi-structure emplacement or airfields.<br><br>Steep grades, excessive amounts of cut and fill, and potential stability problems make construction of roadways across this unit undesirable; heavy maintenance of roadways would be required. A single-lane, unimproved road leading from Tularosa Basin to the Otero Mesa crosses a segment of this unit through Rough Canyon (grid reference 164845).<br><br>Support of moderately to heavily loaded structures on shallow foundations generally would not be desirable because of loose subsurface deposits that are subject to creep movements, landslides, and rockfalls. Construction of pile or pier foundations would be extremely difficult in most areas due to the presence of large rocks and boulders. Stabilization of the slopes would not, in general, be practicable.<br><br>Because of access problems, unit would not provide a good source of construction aggregates. Large rip-rap is available, but access generally would be difficult.<br><br>The materials are unsuited for the disposal of liquid or solid wastes. | Excavation with power equipment generally would be difficult in this unit. Large boulders and blocks would have to be blasted, pushed to the side, or removed with a large front-end loader or power shovel.<br><br>Steep, unstable slopes would cause both access and excavation problems in both the Otero Mesa and Sacramento Mountain areas. Tunneling in these unconsolidated materials would be extremely difficult due to the presence of large boulders, the highly variable subsurface conditions, and the generally unstable nature of these materials. Tunnel and trench support would be required. | There are no currently developed nor potential pits or quarries.<br><br>Some of the boulder and talus deposits are suitable for rip-rap; much of this material could be crushed for construction aggregate, portland cement concrete, asphaltic concrete, and base course material. However, material is generally not economically developable for construction aggregate sources because of limited access and steep slopes. Stable pit slopes would be difficult to construct and maintain.<br><br>Rockfalls, landslides, and soil creep movements all present serious hazards. Sources of wash water are not present. |

# E. ENGINEERING GEOLOGY (Continued)

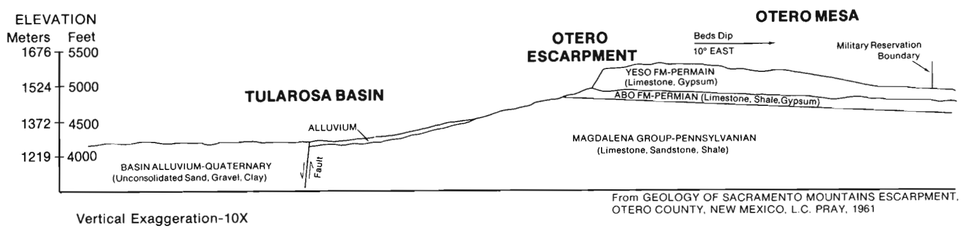
**LOCATION DIAGRAM OF GEOLOGICAL CROSS-SECTION**




**SECTION A-A′**
**(see location diagram)**



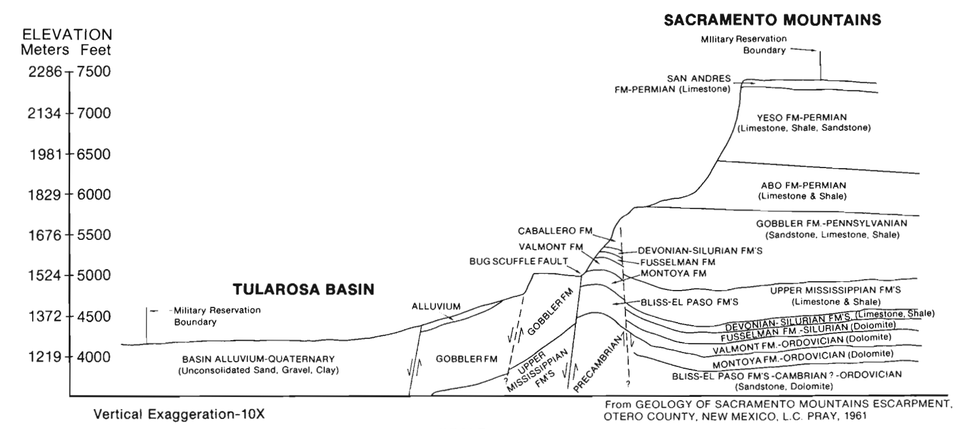

**SECTION B-B′**
**(see location diagram)**

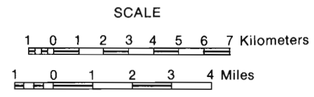






**SECTION C-C′**
**(see location diagram)**




**DEVELOPED PITS, QUARRIES, MINES, AND OIL WELLS**

| MAP NUMBER | GRID REFERENCE | MAP SHEET | TYPE | REMARKS |
|---|---|---|---|---|
| 1 | 898566 | 2 | Pit | Sand, gravel |
| 2 | 650732 | 2 | Pit | Sand, gravel |
| 3 | 519637 | 2 | Vertical shaft | Fluorite, barite |
| 4 | 981816 | 2-3 | Pit | Sand, gravel |
| 5 | 925848 | 2-3 | Pit | Sand, gravel |
| 6 | 835560 | 2 | Oil well | Ernest No. 1/Located Land Company, abandoned, location approximate |
| 7 | 959537 | 3 | Oil well | Wildcat, abandoned |
| 8 | 965530 | 3 | Oil well | Wildcat, abandoned |
| 9 | 997514 | 3 | Oil well | Wildcat, abandoned |
| 10 | 140702 | 3 | Oil well | Kinney Oil Co. No. 1/State, abandoned, location approximate |
| 11 | 114869 | 4 | Oil well | Otero No. 1/McGregor, abandoned, location approximate |
| 12 | 924307 | 1 | Horizontal shaft | Cinnabar, abandoned |
| 13 | 926311 | 1 | Horizontal shaft | Cinnabar, abandoned |
| 14 | 668252 | 1 | Pit | Sand, caliche |
| 15 | 704228 | 1 | Pit | Sand, caliche |
| 16 | 714247 | 1 | Pit | Sand, caliche |
| 17 | 722257 | 1 | Pit | Sand, caliche |
| 18 | 776203 | 1 | Pit | Sand, caliche |
| 19 | 929383 | 1 | Pit | Sand, caliche |
| 20 | 050039 | 4 | Oil well | Plymouth Oil Co. No. 1/Evans Federal, abandoned, location approximate |
| 21 | 166986 | 4 | Oil well | Sun Oil Co. No. 1/Pearson, abandoned, location approximate |

# E. ENGINEERING GEOLOGY (Continued)

**SUMMARY OF PHYSICAL PROPERTIES OF MATERIALS AT POTENTIAL PIT AND QUARRY SITES***

| MAP NUMBER | GRID REFERENCE | MAP SHEET | FORMATION | TYPE MATERIAL | ESTIMATED QUANTITY | QUALITY OF MATERIAL | THICKNESS | OVERBURDEN | LOS ANGELES WEAR (%) | MAXIMUM SIZE | % RETAINED BY 51 mm (2 in) SIEVE | CRUSHED TO | GRADATION 51 mm (2 in) | 25 mm (1 in) | 13 mm (½ in) | No. 4 | No. 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 777509 | 2 | Alluvium and basin deposits and other surficial deposits | Sand | 114,696 m³ (4,050,000 ft³) | Fair | 1.8 m (6 ft) | 0.3 m (1 ft) | No data | No data | No data | As received | | | | | 21 |
| 2 | 942760 | 2-3 | Alluvium and basin deposits and other surficial deposits | Caliche | 76,464 m³ (2,700,000 ft³) | Fair | 1.2 m (4 ft) | 0.3 - 1.2 m (1 - 4 ft) | Caprock: 57.8<br>Soft Caliche: 63.6 | 51 mm (2 in) | 10 | 25 mm (1 in)<br>As received | 89 | 100<br>84 | 81<br>68 | 33<br>39 | 5<br>6 |
| 3 | 986504 | 1-3 | Alluvium | Gravel | 458,784 m³ (16,200,000 ft³) | Good | 9.1 m (30 ft) | 0 - 1.8 m (0 - 6 ft) | 20.0 | 254 mm (10 in) | 25 | As received | 74 | 59 | 35 | 20 | 5 |
| 4 | 988432 | 1 | Alluvium | Gravel | 458,784 m³ (16,200,000 ft³) | Good | 6 m (20 ft) | 0.6 m (2 ft) | 21.2 | 305 mm (12 in) | 30 | As received | 57 | 42 | 27 | 17 | 4 |
| 5 | 077410 | 1 | Limestone and dolomite | Rhyolite (intrusive) | 15,293 m³ (540,000 ft³) | Fair | Variable | 0.3 m (1 ft) | 35.2 | No data | No data | 25 mm (1 in) | | 100 | 77 | 30 | 2 |
| 6 | 098429 | 1 | Alluvium | Gravel | 76,464 m³ (2,700,000 ft³) | Good | 4.6 m (15 ft) | 0 - 0.6 m (0 - 2 ft) | 25.0 | 203 mm (8 in) | 25 | As received | 76 | 61 | 44 | 27 | 6 |
| 7 | 103514 | 3 | Hueco Limestone | Limestone | Unlimited | Excellent | 6 m (20 ft) | 0 - 0.6 m (0 - 2 ft) | 20.0 | No data | No data | 25 mm (1 in) | | 100 | 66 | 27 | 2 |
| 8 | 368948 | 4 | Alluvium | Gravel | Unlimited | Good | 1.5 m (5 ft) | 0.3 m (1 ft) | 21.0 | 508 mm (20 in) | 30 | As received | 85 | 69 | 46 | 22 | 3 |
| 9 | 292938 | 4 | Alluvium | Gravel | Unlimited | Good | 1.2 m (4 ft) | 0.3 m (1 ft) | 17.2 | 229 mm (9 in) | 25 | As received | 74 | 46 | 32 | 22 | 6 |
| 10 | 243934 | 4 | Alluvium | Sand and Gravel | 114,696 m³ (4,050,000 ft³) | Excellent | 2.4 m (8 ft) | None | 21.2 | 102 mm (4 in) | 18 | 25 mm (1 in) | | 100 | 59 | 26 | 5 |
| 11 | 167126 | 4 | Alluvium | Sand and Gravel | 152,928 m³ (5,400,000 ft³) | Excellent | 1.8 m (6 ft) | 0.3 m (1 ft) | 20.0 | 635 mm (25 in) | 15 | As received | 89 | 60 | 42 | 27 | 8 |
| 12 | 185059 | 4 | Alluvium | Gravel and Sand | 152,928 m³ (5,400,000 ft³) | Excellent | 2.1 m (7 ft) | 0.3 m (1 ft) | 28.4 | 305 mm (12 in) | 15 | As received | 85 | 67 | 40 | 22 | 3 |
| 13 | 202056 | 4 | Alluvium | Sand | 305,856 m³ (10,800,000 ft³) | Good | 1.5 m (5 ft) | None | | No. 40 Screen | No data | As received | | | | | 4 |
| 14 | 181996 | 4 | Alluvium | Gravel | 76,464 m³ (2,700,000 ft³) | Good | 1.2 m (4 ft) | 0.6 m (2 ft) | 35.0 | 203 mm (8 in) | 37 | As received | 63 | 51 | 36 | 21 | 2 |
| 15 | 265011 | 4 | Yeso | Limestone | 76,464 m³ (2,700,000 ft³) | Good | 1.8 m (6 ft) | 0.3 m (1 ft) | 26.0 | No data | No data | 25 mm (1 in) | | 100 | 52 | 21 | 3 |
| 16 | 311966 | 4 | Yeso | Caliche coated limestone | Unlimited | Good | 1.2 m (4 ft) | 0.2 m (0.5 ft) | 24.4 | No data | No data | 25 mm (1 in) | | 100 | 62 | 25 | 3 |
| 17 | 394021 | 4 | Alluvium | Gravel | 152,928 m³ (5,400,000 ft³) | Excellent | 1.5 m (5 ft) | 0.2 m (0.5 ft) | 27.4 | 178 mm (7 in) | 26 | As received | 52 | 36 | 24 | 16 | 7 |
| 18 | 465009 | 4 | Alluvium | Sand and Gravel | 382,320 m³ (13,500,000 ft³) | Excellent | 4.6 m (15 ft) | 0.3 m (1 ft) | 24.8 | 432 mm (17 in) | 10 | As received | 90 | 80 | 67 | 26 | 3 |

* Data obtained from GEOLOGY AND AGGREGATE RESOURCES, DISTRICT II, New Mexico State Highway Department, Santa Fe, New Mexico, 1972.

**MATERIALS EXPLORATION SITES***

| MAP NUMBER | GRID REFERENCE | MAP SHEET | MATERIAL |
|---|---|---|---|
| 1 | 601507 | 1-2 | Sand, gravel |
| 2 | 705616 | 2 | Sand, gravel |
| 3 | 197616 | 3 | No data |
| 4 | 089653 | 3 | Limestone |
| 5 | 233675 | 3 | No data |
| 6 | 103744 | 3 | Sand, gravel |
| 7 | 101793 | 3 | Sand, gravel |
| 8 | 112811 | 3 | No data |
| 9 | 213814 | 3 | No data |
| 10 | 259785 | 3 | No data |
| 11 | 361769 | 3 | No data |
| 12 | 132899 | 4 | Sand, gravel |
| 13 | 163967 | 4 | Sand, gravel |
| 14 | 242979 | 4 | Limestone |
| 15 | 454951 | 4 | Sand, gravel |
| 16 | 458962 | 4 | Sand, gravel |
| 17 | 411869 | 4 | No data |
| 18 | 929383 | 1 | Limestone |
| 19 | 076431 | 1 | Tertiary Intrusives |
| 20 | 073442 | 1 | Tertiary Intrusives |
| 21 | 078457 | 1 | Tertiary Intrusives |
| 22 | 530618 | 2 | Limestone, dolomite |
| 23 | 566646 | 2 | Limestone, dolomite |
| 24 | 544660 | 2 | Tertiary Intrusives |
| 25 | 162787 | 3 | Limestone |
| 26 | 161793 | 3 | Limestone |

* Potential pit and quarry sites identified but materials not tested. Locations obtained from GEOLOGY AND AGGREGATE RESOURCES, DISTRICT II, New Mexico State Highway Department, Santa Fe, New Mexico, 1972.

# F. SPECIAL PHYSICAL PHENOMENA

Fort Bliss is in seismic-risk zone I, the "Minor Risk of Damage" category, which corresponds to a Modified Mercalli Intensity of approximately V or VI. In areas having this category it is usually considered that distant earthquakes could cause minor structural damage. Earthquakes felt on the reservation in recent times have not been reported to have caused any significant damage.

The only recorded earthquake having an epicenter close to Fort Bliss occurred 12 May 1969, with an intensity of VI on the Modified Mercalli Scale of 1931. The epicenter was at grid reference 676190, near the reservation boundary at El Paso International Airport and adjacent to the Van Horne Park military housing subdivision. The first two shocks had magnitudes on the Richter Scale of 3.4 and 3.3. The only damage reported was to a single house in Van Horne Park; damage was limited to hairline cracks on an interior ceiling and minor cracks in a concrete driveway. Major faults exist on both sides of the Tularosa Basin near the base of the uplands and Otero Mesa Escarpment. Truncation of intercanyon spurs and minor dislocations of Cenozoic sediments indicate that movement along these faults may have continued into recent time. Movement along these faults, however, apparently was not the cause of the 12 May 1969 earthquake.

Active rockfalls, landslides, and creep movements are a potential hazard in Map Unit 2 along the edge of the Sacramento Mountains and Otero Mesa escarpment, and immediately below the escarpment in the talus and colluvial deposits of Map Unit 7. In some areas the top of the escarpment has a disturbed appearance. Slope debris consisting of large blocky rocks and boulders up to 3 m (10 ft) in size and gravel randomly mixed with silt and sand are found along the sides of the escarpments. The escarpment is slowly receding to the east, although slide activity in localized areas may be frequent. Stabilization of the escarpments is not practical. Additional rockfalls of very limited extent also occur in other rugged areas of Map Units 1 and 2.

Relatively stable, low sand dunes generally less than 3 m (10 ft) in height cover much of the Tularosa Basin. Sand dune movement is to the east, but the rate of movement is slight. The dune sands consist of quartz, feldspar, calcite, and gypsum. The dunes are reasonably well stabilized by mesquite; artificial stabilization has not been necessary. Damage to facilities has not been reported, but the potential should be evaluated for each new project. Blowing sand, silt, and dust from the dune areas when disturbed by vehicles is a problem throughout the year; during high winds, blowing particles consititute a problem even if the dunes are not otherwise disturbed.

A basaltic lava field, known as Carrizozo Malpais, in the northern part of the Tularosa Basin extends southward into Otero County about 16 km (10 mi). At least two flows of recent age issued from a vent near Carrizozo to form a lava field about 71 km (44 mi) long and 0.8 to 8 km (0.5 to 5 mi) wide. Although the lava flow did not reach the reservation, it is one of the most significant features of recent times in the Tularosa Basin.

JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 3

JOINS MAP 1

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
ORO GRANDE
PENDEJO WASH
PRATHER RANCH
(Pictomap - Series V7910)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782

PERSHING FIRING FAN
(Impact Closed to Civilians)

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

HUECO MOUNTAINS

SACRAMENTO MOUNTAINS

FRANKLIN MOUNTAINS

EL PASO

BIGGS FIELD

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING GEOLOGY

**NUMEROUS ENGINEERING USES**

1. Granite, Tertiary intrusive igneous, and pre-Cambrian crystalline rocks.
2. Hard limestone and dolomite with interbedded sandstone and shale.
3. Sandy alluvial basin deposits.
4. Gravelly alluvial fan deposits.

**SOME ENGINEERING USES**

5. Granular stream and slope deposits.

**FEW ENGINEERING USES**

6. Gravel-covered pediment deposits.

Does not appear on this map

7. Rockfall, talus, and colluvial slope deposits.

**CONSTRUCTION MATERIALS**

- Developed pit or quarry
- Potential pit or quarry
- Material exploration site
- Sand dunes
- Does not appear on this map — Oil well
- Does not appear on this map — Vertical mine shaft
- Fault line

Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

WHITE SANDS MISSILE RANGE

MILITARY RESERVATION

WHITE SANDS MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST STAGE IMPACT AREA

(TEMPORARY CLOSINGS ONLY)

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 500 0 1000 2000 3000 Meters

CONTOUR INTERVAL 40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS

ORGAN PEAK · WHITE SANDS · OROGRANDE · PENDEJO WASH · PRATHER RANCH (Pictomap - Series V7810)

LA MESA · NEWMAN · DESERT · BASSETT LAKE

FORT BLISS · HUECO TANKS

Series V781 4747 IV / Series V782 4747 I

Inset

# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING GEOLOGY

**NUMEROUS ENGINEERING USES**

1. Granite, Tertiary intrusive igneous, and pre-Cambrian crystalline rocks.
2. Hard limestone and dolomite with interbedded sandstone and shale.
3. Sandy alluvial basin deposits.
4. Gravelly alluvial fan deposits.

**SOME ENGINEERING USES**

Does not appear on this map — 5. Granular stream and slope deposits.

**FEW ENGINEERING USES**

6. Gravel-covered pediment deposits.

Does not appear on this map — 7. Rockfall, talus, and colluvial slope deposits.

**CONSTRUCTION MATERIALS**

1 Developed pit or quarry

2 Potential pit or quarry

3 Material exploration site

Sand dunes

OIL 4 Oil well

5 Vertical mine shaft

Fault line

Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 3

JOINS MAP 1

JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST-STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

OTERO MESA

HUECO MOUNTAINS

Orogrande

Fort Bliss

Mescalero Apache Reservation

Scale 1:50,000

CONTOUR INTERVAL

Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheets 4848 III, 4848 IV
50 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
OROGRANDE
PENDEJO WASH
PRATHER RANCH (Pictorial - Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS

# MAP 3
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING GEOLOGY

**NUMEROUS ENGINEERING USES**

1. Granite, Tertiary intrusive igneous, and pre-Cambrian crystalline rocks.
2. Hard limestone and dolomite with interbedded sandstone and shale.
3. Sandy alluvial basin deposits.
4. Gravelly alluvial fan deposits.

**SOME ENGINEERING USES**

5. Granular stream and slope deposits.

**FEW ENGINEERING USES**

6. Gravel-covered pediment deposits.
7. Rockfall, talus, and colluvial slope deposits.

**CONSTRUCTION MATERIALS**

- Developed pit or quarry
- Potential pit or quarry
- Material exploration site
- Sand dunes
- Oil well
- Vertical mine shaft
- Fault line (Does not appear on this map)

Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## ENGINEERING GEOLOGY

**NUMEROUS ENGINEERING USES**

1. Granite, Tertiary intrusive igneous, and pre-Cambrian crystalline rocks.
2. Hard limestone and dolomite with interbedded sandstone and shale.
3. Sandy alluvial basin deposits.
4. Gravelly alluvial fan deposits.

**SOME ENGINEERING USES**

5. Granular stream and slope deposits.

**FEW ENGINEERING USES**

6. Gravel-covered pediment deposits.
7. Rockfall, talus, and colluvial slope deposits.

**CONSTRUCTION MATERIALS**

Does not appear on this map — 1. Developed pit or quarry

2. Potential pit or quarry

3. Material exploration site

Sand dunes

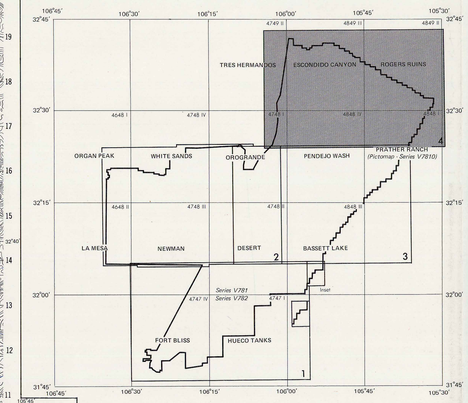
OIL 4. Oil well

Does not appear on this map — 5. Vertical mine shaft

Fault line

Number refers to entry in table.

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, September 1978.

Scale 1:50,000

CONTOUR INTERVAL

Sheet 4748 I
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4749 II
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheet 4849 II
40 FEET

Sheets 4848 IV, 4849 III
50 FEET

LINCOLN NATIONAL FOREST
FORT BLISS MILITARY RESERVATION
McGREGOR GUIDED MISSILE RANGE
SACRAMENTO MOUNTAINS
OTERO MESA
TULAROSA VALLEY
Lone Butte
Organ Peak
Sierra Blanca
Salt Basin Graben
Salt Basin Overthrust
Hueco Tanks
Hueco Mountains
Diablo Plateau
Malone Mountains
Eagle Mountains
Quitman Mountains
Van Horn Mountains
Wylie Mountains
Davis Mountains
Guadalupe Mountains
Carrizozo Malpais
Rio Grande
Texas
New Mexico
Mexico
JOINS MAP 2
JOINS MAP 3
JOINS MAP 3

# G. VEGETATION

Fort Bliss encompasses three distinctly different vegetated topographic regions: desert plain, mesa, and mountain. Desert-plain vegetation includes two shrub types, Mesquite Sand Dune and Creosote Bush Alluvial Fan. Mesa vegetation is predominantly short grasses; the mountains and hills contain areas of shrubs at low elevations and evergreen trees at higher elevations.

The vegetation on Fort Bliss is classified into evergreen forest, evergreen scrub, deciduous scrub, and short grasses (see accompanying maps). Forest and scrub units are further divided into two categories each, based on crown cover density. An additional unit delineates areas where vegetation is insignificant. Only one percent of the reservation is covered by evergreen forest. These forests are along the northern and western boundaries of the reservation in the Sacramento and Organ Mountains. Evergreen scrub, occupying 38 percent of the reservation, occurs throughout the remainder of the mountains and on alluvial fans. Deciduous scrub, occupying 38 percent of the reservation, is restricted mainly to flat-lying plains of the Tularosa Valley. Short grasses, occupying 21 percent of the reservation, dominate the Otero Mesa and the washes and occur sporadically throughout the Tularosa Valley.

The vegetation at Fort Bliss has several unique characteristics significant to military training and operations. Forested areas in the Sacramento Mountains, used for survival training, include both needleleaf and broadleaf evergreen species. Most of the deciduous scrub on the desert plains is in dune areas stabilized by mesquite and sagebrush; both the relief of the dunes and their vegetation were considered in evaluating cover and concealment. The dense deciduous scrub and dense evergreen forests are the only units which cause a significant deviation in the speed or path travelled by man or vehicle from one point to another.

Wildlife management is practiced by both national forest and reservation personnel on Fort Bliss. The evergreen trees and scrub and the deciduous scrub areas are the best wildlife habitats. Upland game birds and mammals are encouraged by the management programs. Cattle are presently being grazed on the reservation, primarily on Otero Mesa by the Bureau of Land Management.

The map units were delineated primarily according to their cover and concealment characteristics. The closely spaced evergreen trees and deciduous scrub provide the best cover. The widely spaced evergreen trees, evergreen scrub, and the short grasses afford little or no cover. The evergreen trees and deciduous scrub provide the best concealment from ground observation. The evergreen scrub and short grasses afford minimal concealment from ground observation. The closely spaced evergreen trees provide the best concealment from aerial observation. All other vegetation affords minimal cover and concealment from aerial observation. Seasonality does not significantly affect cover and concealment at Fort Bliss.

| MAP UNIT | DESCRIPTION | DISTRIBUTION | REMARKS | COVER | CONCEALMENT |
|---|---|---|---|---|---|
| 1. Evergreen needleleaf and broadleaf trees; medium to dense spacing. | Evergreen trees; 50 to 100% crown cover density, average 85%; predominantly alligator and one-seed juniper, pinyon pine, shrub live oak, and spiny hackberry; heights[1] range from 4 to 9 m (12 to 30 ft), average 5 m (16 ft); diameters[2] range from 13 to 51 cm (5 to 20 in), average 28 cm (11 in); spacing[3] ranges from 8 to 14 m (25 to 45 ft), average 9 m (30 ft); understory lacking; undergrowth is sparse and of little diversity, cacti and short grasses predominate. | Restricted to high elevations, above 1890 m (6200 ft), of the Sacramento and Organ Mountains. Constitutes less than 1% of the reservation. | The portion in the Sacramento Mountains is in the Lincoln National Forest. Managed for wildlife. Fire prevention is practiced. There are no commercial timber resources. | Cover from flat-trajectory fire of small arms is fair. | Concealment from ground observation for both foot troops and vehicles is good year-round. Concealment from aerial observation is good for foot troops and fair to good for vehicles year-round. |
| 2. Evergreen needleleaf and broadleaf trees; nearly open to medium spacing. | Evergreen trees; 10 to 50% crown cover density, average 20%; predominantly alligator and one-seed juniper, pinyon pine, shrub live oak, and spiny hackberry; heights range from 4 to 8 m (12 to 25 ft), average 6 m (19 ft); diameters range from 15 to 61 cm (6 to 24 in), average 32 cm (13 in); spacing ranges from 15 to 23 m (50 to 75 ft), average 20 m (66 ft); well developed shrub understory with evergreens such as allthorn, agrito, and coffeeberry bush and deciduous species such as little-leaf sumac, hawthorns and acacias, height of understory extremely variable, ranging from 0.5 to 2 m (2 to 6 ft); undergrowth consists of yuccas, agaves, sotols, cacti and many species of short grasses. | Restricted to the Sacramento and Organ Mountains, between elevations of 1830 to 1980 m (6000 to 6500 ft), just below areas of Map Unit 1. Constitutes less than 1% of the reservation. | The portion in the Sacramento Mountains is in the Lincoln National Forest. Managed for wildlife. Fire prevention is practiced. There are no commercial timber resources. | Cover from flat-trajectory fire of small arms is poor. | Concealment from ground observation is fair for foot troops and poor to fair for vehicles year-round. Concealment from aerial observation is fair to good for foot troops and poor to fair for vehicles year-round. |
| 3. Evergreen needleleaf and broadleaf scrub; medium to dense spacing. | Evergreen scrub; 50 to 100% crown cover density, average 60%; predominantly creosote bush with occasional little-leaf sumacs and cacti; tarbush is common in the washes; heights range from 0.5 to 2 m (2 to 6 ft), average 1.4 m (4.5 ft); diameters were not measurable; spacing ranges from 2 to 5 m (6 to 15 ft), average 3 m (9 ft); undergrowth consists of a variety of grasses and forbs, predominantly fluffgrass, bush muhly, alkali sacaton, broom snakeweed, and pepperweed. Apache plume and tobosa grass are associated with tarbush in the washes. | Found commonly on alluvial fans, and less commonly on flat-lying plains of the Tularosa Valley where the depth to the caliche layer is shallow. Seldom occurs on slopes greater than 10%. Constitutes 20% of the reservation. | Fire prevention is important because creosote bush is very flammable. This map unit is poor wildlife habitat. | Cover from flat-trajectory fire of small arms is nonexistent. | Concealment from ground observation is fair to good for foot troops and poor for vehicles year-round. Concealment from aerial observation is poor for foot troops and poor to nonexistent for vehicles year-round. |
| 4. Evergreen needleleaf and broadleaf scrub; nearly open to medium spacing. | Evergreen scrub; 10 to 50% crown cover density, average 30%; predominantly creosote bush with torrey mesquite and fourwing saltbush (both locally common) and occasional little-leaf sumacs and cacti; a few areas dominated by sagebrushes; tarbush is common in the washes; heights range from 0.5 to 2 m (2 to 6 ft), average 1.5 m (4.5 ft); diameters were not measurable; spacing ranges from 5 to 8 m (15 to 25 ft), averaging approximately 6 m (20 ft); undergrowth consists of a variety of grasses and forbs, predominantly fluffgrass, bush muhly, alkali sacaton, broom snakeweed, and pepperweed. Dalea and sacaton are common in sagebrush areas. Apache plume and tobosa grass are associated with tarbush in the washes. | Dominates moderate to very steep slopes of the mesa and mountains. Infrequently on Otero Mesa and on hillocks in the Tularosa Valley. Seldom occurs on slopes less than 10%. Constitutes 18% of the reservation. | Although the shrubs are farther apart, the grass cover is usually much thicker, making fire a problem. This map unit is fair wildlife habitat. | Cover from flat-trajectory fire of small arms is nonexistent. | Concealment from ground observation is poor to fair for foot troops and poor for vehicles year-round. Concealment from aerial observation is poor for foot troops and nonexistent for vehicles year-round. |
| 5. Deciduous broadleaf scrub; medium to dense spacing. | Deciduous scrub, restricted primarily to dune areas; 35 to 100% crown cover density, average 55%, predominantly torrey mesquite with occasional fourwing saltbush; heights range from 1 to 4 m (3 to 12 ft), average 2 m (6 ft). Dunes are usually oblong, average 11 m (35 ft) long, 6 m (20 ft) wide; average interdunal spacing is 8 m (25 ft). Associated species in interdunal areas include broom snakeweed, plains lovegrass, fluffgrass, white-stem paperflower, and isolated creosote bush. | Frequents flat-lying plains throughout the Tularosa Valley. Very rare on slopes greater than 5%. Constitutes 34% of the reservation. | The dunes are very sensitive to mechanical and environmental distrubances such as vehicle movement or fire. If the vegetation is destroyed, sands begin to shift. Shifting sands are detrimental to ground navigation and troop mobility. Damaged dunes may not restabilize in the same location. | Cover from flat-trajectory fire of small arms is good. | Concealment from ground observation is good for foot troops and fair to good for vehicles year-round. Concealment from aerial observation is poor to fair for foot troops and poor for vehicles year-round. |
| 6. Deciduous broadleaf scrub; nearly open to medium spacing. | Deciduous scrub, restricted primarily to dune areas; 10 to 35% crown cover density, average 25%; predominantly torrey mesquite and sagebrushes with occasional fourwing saltbush; heights range from 1 to 3 m (3 to 9 ft), average 2 m (6 ft). Dunes are usually oblong, average 9 m (30 ft) long, 6 m (20 ft) wide; average interdunal spacing is 17 m (55 ft). Associated species in interdunal areas include broom snakeweed, plains lovegrass, fluffgrass, white-stem paperflower, and isolated creosote bush. | Occurs sporadically on flat-lying plains throughout the Tularosa Valley. Very rare on slopes greater than 5%. Constitutes 4% of the reservation. | The dunes are very sensitive to mechanical and environmental disturbances such as vehicle movement or fire. If the vegetation is destroyed, sands begin to shift. Shifting sands are detrimental to ground navigation and troop mobility. Damaged dunes may not restabilize in the same location. | Cover from flat-trajectory fire of small arms is good. | Concealment from ground observation is good for foot troops and fair to good for vehicles year-round. Concealment from aerial observation is poor to fair for foot troops and poor for vehicles year-round. |
| 7. Short grasses. | Short grasses; alkali sacaton, giant dropseed, bush muhly, fluffgrass and burrograss are common in the Tularosa Valley with blue, black, sideoats and gyp grama, fluffgrass, mesa dropseed and tobosa grass common on slopes and the mesa; heights range from 7 to 100 cm (3 to 40 in), average 25 cm (10 in). Associated shrubs include ephedra, cacti, little-leaf sumac, creosote, mesquite, yucca, and acacia. | Very common on Otero Mesa and in washes and less common and sporadic in the Tularosa Valley. Occurs on a variety of slopes on the mesa and in flat-lying areas in the valley. Constitutes 21% of the reservation. | This unit provides fair to good cattle rangeland, especially on the Otero Mesa. Cattle grazing is active in most areas, and erosion resulting from overgrazing is sometimes a problem. Fires are common and usually detrimental to rangeland. Prescribed fire is utilized occasionally on small areas for game bird management. | Cover from flat-trajectory fire of small arms is nonexistent. | Concealment from aerial or ground observation for foot troops or vehicles is nonexistent year-round. |
| 8. Built-up areas, barren areas, and heavily used areas. Vegetation is not a significant factor. | Cantonment, range camps, heavily used training areas, and landfills. | Includes the main cantonment at El Paso; the McGregor, Dona Ana, Orogrande, and North McGregor Range Camps, all in the Tularosa Valley and north of the Texas-New Mexico state line; the training areas associated with these camps; and the sanitary landfill immediately north of the cantonment. Constitutes 2% of the reservation. | | | |

[1]Height measurements taken as total height.
[2]Diameter measurements taken at breast height, 1.5 meters (4.5 feet) above ground level.
[3]Spacing measurements taken from main stem to main stem.

JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 1

JOINS MAP 3

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
ORO GRANDE
PENDEJO WASH
PRATHER RANCH
(Pictomap - Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782
Inset

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

TULAROSA VALLEY

HUECO MOUNTAINS

FRANKLIN MOUNTAINS

NEW MEXICO
TEXAS

OTERO COUNTY
DONA ANA COUNTY

EL PASO

Mountain View

Bel Air

Holiem Drive

BIGGS FIELD

Alto Vista

Mt. Mesa School

Newman

Airfield

Landing strip

Aqueduct

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY
CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## VEGETATION

### FORESTS

Does not appear on this map — 1. Evergreen needleleaf and broadleaf trees; medium to dense spacing.

Does not appear on this map — 2. Evergreen needleleaf and broadleaf trees; nearly open to medium spacing.

### SCRUB

3. Evergreen needleleaf and broadleaf scrub; medium to dense spacing.

4. Evergreen needleleaf and broadleaf scrub; nearly open to medium spacing.

5. Deciduous broadleaf scrub; medium to dense spacing.

6. Deciduous broadleaf scrub; nearly open to medium spacing.

### GRASSLANDS

7. Short grasses.

### OPEN

OPEN — 8. Built-up areas, barren areas, and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1975.

JOINS MAP 4

WHITE SANDS MISSILE RANGE

McGREGOR GUIDED MISSILE RANGE

MC GREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

WHITE SANDS MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST STAGE IMPACT AREA

(TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

DONA ANA IMPACT AREA

DONA ANA COUNTY / OTERO COUNTY

FORT BLISS MILITARY RESERVATION

PERSHING FIRING FAN

(TEMPORARY CLOSINGS ONLY)

JOINS MAP 3

JOINS MAP 1

Scale 1:50,000

CONTOUR INTERVAL 40 FEET
WITH SUPPLEMENTARY
CONTOURS AT 20 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS · ORGAN PEAK · WHITE SANDS · OROGRANDE · PENDEJO WASH · PRATHER RANCH (Picatinny Series V7810) · LA MESA · NEWMAN · DESERT · BASSETT LAKE · FORT BLISS · HUECO TANKS

Series V781
Series V782

# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## VEGETATION

**FORESTS**

1. Evergreen needleleaf and broadleaf trees; medium to dense spacing.
2. Evergreen needleleaf and broadleaf trees; nearly open to medium spacing.

**SCRUB**

3. Evergreen needleleaf and broadleaf scrub; medium to dense spacing.
4. Evergreen needleleaf and broadleaf scrub; nearly open to medium spacing.
5. Deciduous broadleaf scrub; medium to dense spacing.
6. Deciduous broadleaf scrub; nearly open to medium spacing.

**GRASSLANDS**

7. Short grasses.

**OPEN**

OPEN 8. Built-up areas, barren areas, and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, September 1978.

JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

MCGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST-STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

OTERO MESA

SACRAMENTO MOUNTAINS

Orogrande

Scale 1:50,000

CONTOUR INTERVAL

Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheets 4848 III, 4848 IV
50 FEET

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
OROGRANDE
PENDEJO WASH
PRATHER RANCH (Pictorial, Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782
Inset

# MAP 3
# FORT BLISS, TEXAS TERRAIN ANALYSIS

## VEGETATION

### FORESTS

Does not appear on this map — 1. Evergreen needleleaf and broadleaf trees; medium to dense spacing.

Does not appear on this map — 2. Evergreen needleleaf and broadleaf trees; nearly open to medium spacing.

### SCRUB

3. Evergreen needleleaf and broadleaf scrub; medium to dense spacing.

4. Evergreen needleleaf and broadleaf scrub; nearly open to medium spacing.

5. Deciduous broadleaf scrub; medium to dense spacing.

6. Deciduous broadleaf scrub; nearly open to medium spacing.

### GRASSLANDS

7. Short grasses.

### OPEN

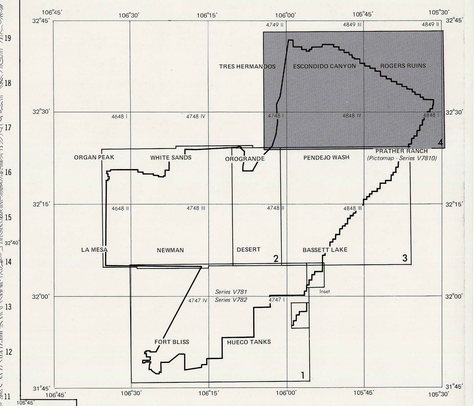
OPEN — 8. Built-up areas, barren areas, and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




## VEGETATION

### FORESTS

1. Evergreen needleleaf and broadleaf trees; medium to dense spacing.
2. Evergreen needleleaf and broadleaf trees; nearly open to medium spacing.

### SCRUB

3. Evergreen needleleaf and broadleaf scrub; medium to dense spacing.
4. Evergreen needleleaf and broadleaf scrub; nearly open to medium spacing.
5. Deciduous broadleaf scrub; medium to dense spacing.
6. Deciduous broadleaf scrub; nearly open to medium spacing.

### GRASSLANDS

7. Short grasses.

Does not appear on this map

8. Built-up areas, barren areas, and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.


Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.


Scale 1:50,000

CONTOUR INTERVAL

Sheet 4748 I
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4749 II
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheet 4849 II
40 FEET

Sheets 4848 IV, 4849 III
80 FEET

LINCOLN NATIONAL FOREST

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

TULAROSA VALLEY

OTERO MESA


JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# H. CLIMATE

The climate at Fort Bliss is that of the arid southwestern United States, with abundant sunshine throughout the year and a wide range in temperature. Rainfall is scanty and humidity is very low. The meteorological station on the installation at Biggs Army Airfield is at elevation 1206 meters (3957 feet) above mean sea level; the highest point on the post is at 2619 meters (8593 feet), at Organ Peak, which is approximately 66 kilometers (41 miles) north-northwest of Biggs AAF. Thus the wide differences in elevation and other aspects of terrain in this large area will produce differences in temperature, wind, and precipitation at different places.

Rainfall throughout the year is light; the annual total is 200.7 millimeters (7.9 inches). More than half of the precipitation occurs in the summer from brief but often heavy thunderstorms. Twenty-four of the 32 days per year with thunderstorms occur during June, July, and August. Periods of several months without any precipitation are not unusual. Small amounts (annually, 127 millimeters or 5 inches) of snow fall nearly every winter, but snow cover rarely amounts to more than 25 millimeters (1 inch) and seldom remains for more than a few hours.

The mean annual maximum temperature is 24.4°C (76°F) and the mean annual minimum temperature is 10.6°C (51°F). Between April and September, temperatures are high, with 97 days above 32.2°C (90°F). The highest temperature during the 21 years of record is 41.7°C (107°F). Summer nights are usually comfortable, with temperatures around 21°C (70°F). Winter days are usually mild, with temperatures ranging from 13.3° to 18.3°C (56° to 65° F). At night the temperatures drop below freezing about half the time in December and January, and an average of 52 days per year reach the freezing point or lower. Temperatures below -12.2°C (10°F) have occurred on only 28 days in over 80 years of record at the adjacent El Paso airport. An extreme low of -22.8°C (-9°F) however, has been recorded at Biggs AAF.

Relative humidities accompanying the hot summer and cool winter temperatures and scant precipitation are low, averaging an annual 52 percent at 0400 local standard time (LST) and 29 percent at 1300 LST. Skies are generally quite clear with an annual mean cloud cover of four-tenths. Ceilings greater than 10,000 feet (3048 meters) with visibility greater than 3 miles (4.8 kilometers) at all hours of the day occur more than 316 days per year.

The mean annual wind speed for the Fort Bliss area is 6 knots (11 kilometers per hour or 7 miles per hour), with the highest mean monthly speed of 8 knots (15 kilometers per hour or 9 miles per hour) occurring in March and April. The 14-year record peak gust is 71 knots (131 kilometers or 82 miles per hour). The Franklin Mountains, which extend northward through the installation, add to the gustiness during high winds and cause changes in direction during periods of light winds. Prevailing winds are from the north during fall and winter and from the west and south during spring and summer. The prevailing direction for the year is from the north.

Wind speeds are not excessively high, but dust storms and sandstorms occur often. Because of the low precipitation, the soil surface is dry and loose and natural vegetation is sparse; thus, moderately strong winds can raise considerable dust and sand. A tabulation of dust storms for a period of 20 years shows that they are most frequent in March and April and comparatively rare in the fall months, although they can occur at all times of the year. During March there are, on the average, nearly 40 hours when visibility is reduced to 6 miles (9.6 kilometers) or less because of dust.

When considering the probability of injury due to heat and cold to persons exposed to the weather for any length of time, two temperature stress indices are commonly used: the "wind chill" temperature for the measurement of cold stress and the Wet Bulb Globe Temperature index (WBGT) for the measurement of heat stress. When a cold air temperature is combined with a high wind speed, the impact on the human body is equivalent to a much lower temperature than when there is no wind. At Fort Bliss the wind chill temperature rarely exceeds -35°C (-30°F) and frostbite from cold exposure offers little hazard to soldiers wearing adequate winter clothing. The WBGT reading combines temperature and humidity factors and is used to determine the magnitude of heat stress on the human body; generally high humidity combined with high temperature results in greater heat stress. Summer WBGT readings may reach 29.4°C (85°F), the level at which Army regulations (TB Med 175) recommend discontinuance of strenuous training by unacclimatized personnel. On rare occasions the summer WBGT readings have reached a figure of 31.1°C (88°F), the level at which Army regulations (TB Med 175) recommend discontinuance of strenuous training by hardened personnel with greater than 12 weeks acclimatization per season. It should be noted that the comparatively dry, clean air, in combination with the high elevation, increases the hazards of severe sunburn, loss of body fluids, and heatstroke.

See the following table for climatic and ephemeral data.

**CLIMATIC SUMMARY***

**Biggs Army Airfield/Fort Bliss  Latitude 31°51'N  Longitude 106°23'W  Elevation 1206m (3957ft)**

| PARAMETER DESCRIPTION | UNIT OF MEASURE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL | YEARS OF RECORD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute maximum temperature | °C | 24.4 | 26.7 | 31.7 | 35.6 | 41.1 | 41.7 | 41.7 | 40.6 | 39.4 | 33.9 | 28.3 | 23.9 | 41.7 | 21 |
| | °F | 76 | 80 | 89 | 96 | 106 | 107 | 107 | 105 | 103 | 93 | 83 | 75 | 107 | 21 |
| Mean daily maximum temperature | °C | 13.3 | 16.7 | 20.0 | 25.0 | 30.0 | 35.0 | 34.4 | 33.3 | 30.6 | 25.6 | 18.3 | 14.4 | 24.4 | 21 |
| | °F | 56 | 62 | 68 | 77 | 86 | 95 | 94 | 92 | 87 | 78 | 65 | 58 | 76 | 21 |
| Mean daily minimum temperature | °C | 0.0 | 2.2 | 5.6 | 10.6 | 15.0 | 20.0 | 21.7 | 21.1 | 17.8 | 11.7 | 3.9 | 0.6 | 10.6 | 21 |
| | °F | 32 | 36 | 42 | 51 | 59 | 68 | 71 | 70 | 64 | 53 | 39 | 33 | 51 | 21 |
| Absolute minimum temperature | °C | -22.8 | -12.8 | -7.2 | -3.3 | 3.3 | 10.6 | 15.6 | 15.0 | 7.8 | 1.1 | -8.3 | -15.0 | -22.8 | 21 |
| | °F | -9 | 9 | 19 | 26 | 38 | 51 | 60 | 59 | 46 | 34 | 17 | 5 | -9 | 21 |
| Mean number days with maximum temperature ≥32.2°C (90°F) | | 0 | 0 | 0 | 1 | 11 | 25 | 25 | 23 | 12 | # | 0 | 0 | 97 | 21 |
| Mean number days with minimum temperature ≤0.0°C (32°F) | | 16 | 9 | 5 | # | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 15 | 52 | 21 |
| Normal heating degree-days (base 18.3°C/65°F)+ | | 622 | 430 | 294 | 104 | 13 | 1 | 0 | 0 | 6 | 84 | 370 | 609 | 2533 | 51 |
| Normal cooling degree-days (base 18.3°C/65°F)+ | | 0 | 1 | 12 | 55 | 217 | 458 | 510 | 462 | 272 | 62 | 1 | 0 | 2049 | 8 |
| Mean dew point temperature | °C | -4.4 | -4.4 | -5.0 | -3.3 | 0.0 | 5.6 | 12.8 | 12.8 | 9.4 | 4.4 | -1.7 | -3.9 | 1.7 | 20 |
| | °F | 24 | 24 | 23 | 26 | 32 | 42 | 55 | 55 | 49 | 40 | 29 | 25 | 35 | 20 |
| Mean percent relative humidity | (at 0400 LST) | 60 | 52 | 43 | 37 | 36 | 41 | 58 | 60 | 57 | 57 | 57 | 62 | 52 | 20 |
| | (at 1300 LST) | 37 | 30 | 25 | 20 | 18 | 20 | 31 | 33 | 33 | 32 | 32 | 37 | 29 | 20 |
| Mean monthly precipitation | mm | 10.2 | 10.2 | 7.6 | 7.6 | 7.6 | 12.7 | 40.6 | 35.6 | 30.5 | 17.8 | 7.6 | 12.7 | 200.7 | 21 |
| | in | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.5 | 1.6 | 1.4 | 1.2 | 0.7 | 0.3 | 0.5 | 7.9 | 21 |
| Absolute maximm monthly precipitation+ | mm | 46.7 | 47.8 | 57.4 | 56.9 | 48.8 | 71.6 | 140.5 | 111.5 | 169.7 | 109.5 | 63.5 | 100.1 | 452.1 | 76 |
| | in | 1.84 | 1.88 | 2.26 | 2.24 | 1.92 | 2.82 | 5.53 | 4.39 | 6.68 | 4.31 | 2.50 | 3.94 | 17.80 | 76 |
| Absolute minimum monthly precipitation+ | mm | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | T | T | 0.0 | 0.0 | 0.0 | 69.3 | 85 |
| | in | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | T | T | 0.0 | 0.0 | 0.0 | 2.73 | 85 |
| Mean number days with precipitation ≥0.254 mm (0.01 in) | | 3 | 2 | 2 | 2 | 2 | 3 | 8 | 7 | 4 | 3 | 2 | 3 | 41 | 21 |
| Absolute maximum 24-hr precipitation+ | mm | 15.5 | 22.1 | 43.7 | 27.4 | 31.2 | 36.8 | 66.8 | 50.8 | 64.0 | 45.0 | 30.2 | 26.7 | 66.8 | 37 |
| | in | 0.61 | 0.87 | 1.72 | 1.08 | 1.23 | 1.45 | 2.63 | 2.00 | 2.52 | 1.77 | 1.19 | 1.05 | 2.63 | 37 |
| Mean number days with thunderstorms | | # | # | 1 | 1 | 2 | 4 | 10 | 10 | 3 | 1 | # | # | 32 | 17 |
| Mean monthly snowfall | mm | 25 | 25 | 25 | T | 0 | 0 | 0 | 0 | 0 | T | 25 | 25 | 127 | 17 |
| | in | 1 | 1 | 1 | T | 0 | 0 | 0 | 0 | 0 | T | 1 | 1 | 5 | 17 |
| Mean number days with snowfall ≥2.54 mm (0.1 in) | | 1 | 1 | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | 1 | 3 | 17 |
| Absolute maximum 24-hr snowfall+ | mm | 116.8 | 182.9 | 185.4 | T | 0 | 0 | 0 | 0 | 0 | T | 198.1 | 180.3 | 198.1 | 37 |
| | in | 4.6 | 7.2 | 7.3 | T | 0 | 0 | 0 | 0 | 0 | T | 7.8 | 7.1 | 7.8 | 37 |
| Mean pressure altitude | m | 1311 | 1326 | 1356 | 1326 | 1295 | 1280 | 1250 | 1234 | 1265 | 1280 | 1295 | 1295 | 1311 | 16 |
| | ft | 4300 | 4350 | 4450 | 4350 | 4250 | 4200 | 4100 | 4050 | 4150 | 4200 | 4250 | 4250 | 4300 | 16 |
| Percent frequency of surface wind speed ≥28 knots (51.9 kmph or 32.2 mph) | | 0.1 | 0.5 | 0.6 | 0.6 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 14 |
| Percent frequency of surface wind speed ≥17 knots (31.5 kmph or 19.6 mph) | | 4.8 | 6.7 | 11.4 | 10.0 | 5.9 | 3.2 | 1.7 | 1.1 | 0.6 | 1.3 | 2.9 | 3.6 | 4.4 | 14 |
| Mean number days with surface wind ≥17 knots (31.5 kmph or 19.6 mph) and no precipitation | (at 1700 LST) | 1.3 | 2.4 | 4.8 | 4.5 | 3.2 | 1.0 | 1.3 | 0.5 | 0.2 | 0.3 | 0.8 | 1.5 | 21.8 | 14 |
| | (at 2300 LST) | 1.8 | 1.9 | 2.9 | 3.5 | 2.3 | 1.7 | 0.8 | 0.7 | 0.2 | 0.2 | 0.5 | 0.9 | 17.4 | 14 |
| | (at 0500 LST) | 1.1 | 1.0 | 1.9 | 1.6 | 0.4 | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.3 | 0.8 | 7.6 | 14 |
| | (at 1100 LST) | 1.7 | 2.0 | 2.9 | 2.9 | 1.3 | 0.8 | 0.0 | 0.0 | 0.2 | 0.5 | 1.3 | 1.3 | 14.9 | 14 |
| Mean number days with surface wind 4-10 knots (7.4-18.5 kmph or 4.6-11.5 mph) and temperature 0.6°-31.7°C (33°-89°F) and no precipitation | (at 1700 LST) | 14.3 | 13.6 | 13.9 | 13.1 | 12.4 | 3.4 | 5.1 | 7.2 | 13.1 | 14.8 | 9.9 | 10.4 | 131.2 | 14 |
| | (at 2300 LST) | 8.6 | 9.4 | 11.9 | 11.5 | 12.1 | 13.0 | 14.0 | 13.5 | 9.9 | 9.8 | 8.3 | 9.0 | 131.0 | 14 |
| | (at 0500 LST) | 8.2 | 10.1 | 11.7 | 11.3 | 12.6 | 10.9 | 11.8 | 12.2 | 10.0 | 10.3 | 9.4 | 8.4 | 126.9 | 14 |
| | (at 1100 LST) | 13.8 | 13.0 | 14.6 | 14.5 | 15.9 | 10.2 | 12.6 | 15.1 | 16.3 | 16.2 | 13.3 | 12.3 | 167.8 | 14 |
| Extreme wind speed (peak gust) | knots | 71 | 70 | 56 | 67 | 55 | 49 | 49 | 43 | 42 | 47 | 48 | 56 | 71 | 14 |
| | kmph | 131 | 130 | 104 | 124 | 102 | 91 | 91 | 80 | 78 | 87 | 89 | 104 | 131 | 14 |
| | mph | 82 | 81 | 64 | 77 | 63 | 56 | 56 | 49 | 48 | 54 | 55 | 64 | 82 | 14 |
| Mean number days with an occurrence of visibility ≤0.5 mi (0.8 km) | | 1.4 | 0.9 | 1.6 | 1.0 | 0.7 | 0.6 | 0.5 | 0.1 | 0.2 | 0.2 | 0.4 | 0.7 | 8.3 | 14 |
| Percent frequency ceiling ≤5000 ft (1524 m) or visibility ≤5 mi (8 km) | | 8.1 | 7.5 | 6.5 | 5.1 | 1.7 | 1.3 | 2.0 | 0.9 | 2.5 | 5.9 | 3.6 | 5.9 | 4.3 | 14 |
| Percent frequency ceiling ≤1500 ft (457 m) or visibility ≤3 mi (4.8 km) | (for 0000-0200 LST) | 2.3 | 2.2 | 1.4 | 1.4 | 0.1 | 0.5 | 0.1 | 0.2 | 0.2 | 1.1 | 0.5 | 1.6 | 1.0 | 14 |
| | (for 0300-0500 LST) | 2.8 | 2.1 | 0.6 | 0.6 | 0.0 | 0.1 | 0.6 | 0.2 | 0.3 | 0.7 | 0.9 | 2.1 | 0.9 | 14 |
| | (for 0600-0800 LST) | 3.5 | 2.3 | 1.2 | 0.9 | 0.0 | 0.1 | 0.2 | 0.2 | 0.9 | 0.7 | 0.8 | 2.5 | 1.1 | 14 |
| | (for 0900-1100 LST) | 2.7 | 1.9 | 3.2 | 1.0 | 0.2 | 0.2 | 0.5 | 0.0 | 0.7 | 0.7 | 0.9 | 2.3 | 1.2 | 14 |
| | (for 1200-1400 LST) | 2.5 | 3.6 | 5.0 | 2.9 | 1.1 | 0.2 | 0.2 | 0.2 | 0.5 | 0.7 | 1.1 | 3.1 | 1.8 | 14 |
| | (for 1500-1700 LST) | 2.5 | 4.1 | 5.5 | 4.6 | 2.9 | 1.1 | 0.6 | 0.3 | 0.2 | 0.7 | 1.6 | 2.9 | 2.3 | 14 |
| | (for 1800-2000 LST) | 1.8 | 2.5 | 4.0 | 3.7 | 2.6 | 2.2 | 0.7 | 0.1 | 0.0 | 0.5 | 0.7 | 1.9 | 1.7 | 14 |
| | (for 2100-2300 LST) | 2.0 | 1.6 | 2.2 | 1.5 | 0.5 | 0.3 | 0.3 | 0.3 | 0.0 | 1.1 | 0.6 | 1.2 | 1.0 | 14 |
| Percent frequency ceiling ≤300 ft (91.4 m) or visibility ≤1 mi (1.6 km) | (for 0000-0200 LST) | 0.7 | 0.8 | 0.7 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.4 | 0.3 | 14 |
| | (for 0300-0500 LST) | 1.2 | 0.8 | 0.0 | 0.3 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.3 | 0.1 | 0.3 | 0.3 | 14 |
| | (for 0600-0800 LST) | 1.7 | 0.5 | 0.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.0 | 0.2 | 0.3 | 14 |
| | (for 0900-1100 LST) | 0.8 | 0.6 | 0.9 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.8 | 0.3 | 14 |
| | (for 1200-1400 LST) | 0.2 | 1.4 | 2.5 | 1.5 | 0.4 | 0.0 | 0.1 | 0.1 | 0.0 | 0.3 | 0.6 | 0.9 | 0.7 | 14 |
| | (for 1500-1700 LST) | 0.9 | 1.9 | 3.1 | 1.7 | 1.0 | 0.6 | 0.4 | 0.1 | 0.0 | 0.3 | 0.8 | 1.3 | 1.0 | 14 |
| | (for 1800-2000 LST) | 0.4 | 0.4 | 2.2 | 1.4 | 1.0 | 0.9 | 0.3 | 0.0 | 0.0 | 0.2 | 0.4 | 1.0 | 0.7 | 14 |
| | (for 2100-2300 LST) | 0.8 | 0.1 | 1.4 | 0.4 | 0.2 | 0.1 | 0.2 | 0.2 | 0.0 | 0.0 | 0.5 | 0.3 | 0.4 | 14 |
| Mean number days with sky cover ≤30 percent and visibility ≥3 mi (4.8 km) | (at 1700 LST) | 11.6 | 11.5 | 11.5 | 13.1 | 13.0 | 11.6 | 4.7 | 6.1 | 17.6 | 16.9 | 17.6 | 15.4 | 150.6 | 14 |
| | (at 2300 LST) | 17.6 | 17.7 | 17.6 | 20.3 | 21.7 | 18.5 | 12.8 | 13.2 | 20.7 | 20.8 | 22.1 | 19.7 | 222.7 | 14 |
| | (at 0500 LST) | 18.5 | 18.5 | 18.1 | 17.5 | 18.4 | 16.1 | 10.3 | 14.0 | 20.2 | 22.0 | 22.9 | 21.6 | 218.1 | 14 |
| | (at 1100 LST) | 12.6 | 13.0 | 12.8 | 15.5 | 17.6 | 18.8 | 11.4 | 15.1 | 18.8 | 17.6 | 18.8 | 15.4 | 187.4 | 14 |
| Mean number days with ceiling ≥1000 ft (305 m) and visibility ≥3 mi (4.8 km) | (at 1700 LST) | 30.4 | 26.9 | 29.5 | 28.4 | 30.1 | 29.6 | 30.7 | 30.8 | 30.0 | 30.8 | 29.6 | 30.2 | 357.0 | 14 |
| | (at 2300 LST) | 30.4 | 27.6 | 30.3 | 29.5 | 30.9 | 30.0 | 30.9 | 30.7 | 30.0 | 30.7 | 29.8 | 30.8 | 361.6 | 14 |
| | (at 0500 LST) | 30.4 | 27.7 | 30.9 | 29.7 | 31.0 | 30.0 | 30.8 | 31.0 | 30.0 | 30.8 | 29.9 | 30.6 | 362.8 | 14 |
| | (at 1100 LST) | 30.8 | 27.7 | 29.8 | 29.5 | 30.8 | 29.9 | 31.0 | 31.0 | 29.8 | 30.9 | 29.9 | 30.5 | 361.6 | 14 |
| Mean number days with ceiling ≥2000 ft (610 m) and visibility ≥3 mi (4.8 km) and surface wind ≤ 10 knots (18.5 kmph or 11.5 mph) | (at 1700 LST) | 24.8 | 18.2 | 16.0 | 13.0 | 15.3 | 18.5 | 19.7 | 23.0 | 23.2 | 25.5 | 24.7 | 25.4 | 247.3 | 14 |
| | (at 2300 LST) | 24.7 | 21.4 | 20.6 | 19.4 | 20.0 | 21.1 | 24.6 | 25.8 | 27.0 | 28.2 | 25.4 | 25.8 | 284.0 | 14 |
| | (at 0500 LST) | 25.6 | 22.5 | 23.5 | 23.3 | 27.7 | 27.4 | 27.9 | 28.5 | 28.7 | 28.7 | 26.7 | 26.8 | 317.3 | 14 |
| | (at 1100 LST) | 22.4 | 19.4 | 16.4 | 15.9 | 17.8 | 21.3 | 26.0 | 26.6 | 24.4 | 25.5 | 22.7 | 24.1 | 262.5 | 14 |
| Mean number days with ceiling ≥2500 ft (762 m) and visibility ≥3 mi (4.8 km) | (at 1700 LST) | 29.8 | 26.4 | 29.4 | 28.4 | 30.1 | 29.6 | 30.7 | 30.8 | 30.0 | 30.8 | 29.5 | 29.8 | 355.3 | 14 |
| | (at 2300 LST) | 29.7 | 27.3 | 30.3 | 29.4 | 30.9 | 30.0 | 30.8 | 30.7 | 29.8 | 30.2 | 29.6 | 30.3 | 359.0 | 14 |
| | (at 0500 LST) | 29.8 | 27.1 | 30.6 | 29.6 | 31.0 | 30.0 | 30.5 | 30.9 | 29.7 | 29.8 | 29.5 | 30.1 | 358.6 | 14 |
| | (at 1100 LST) | 29.8 | 27.1 | 29.4 | 29.5 | 30.8 | 29.9 | 30.8 | 31.0 | 29.6 | 30.3 | 29.5 | 29.9 | 357.6 | 14 |
| Mean number days with ceiling ≥6000 ft (1829 m) and visibility ≥3 mi (4.8 km) | (at 1700 LST) | 28.0 | 25.0 | 28.0 | 27.8 | 29.5 | 29.3 | 29.1 | 30.2 | 29.3 | 29.1 | 28.5 | 28.7 | 342.5 | 14 |
| | (at 2300 LST) | 28.7 | 26.6 | 29.9 | 29.2 | 30.7 | 29.8 | 29.8 | 30.2 | 29.5 | 29.3 | 28.9 | 29.5 | 352.1 | 14 |
| | (at 0500 LST) | 28.5 | 25.8 | 29.8 | 28.6 | 30.7 | 29.8 | 30.1 | 30.5 | 29.2 | 28.4 | 29.0 | 29.1 | 349.5 | 14 |
| | (at 1100 LST) | 28.1 | 25.1 | 28.1 | 27.9 | 30.2 | 29.6 | 29.5 | 30.4 | 28.4 | 28.1 | 28.6 | 29.0 | 343.0 | 14 |
| Mean number days with ceiling ≥10,000 ft (3048 m) and visibility ≥3 mi (4.8 km) | (at 1700 LST) | 26.8 | 23.8 | 26.4 | 27.1 | 27.7 | 25.7 | 23.7 | 25.1 | 27.1 | 27.9 | 27.8 | 27.6 | 316.7 | 14 |
| | (at 2300 LST) | 27.7 | 25.6 | 28.6 | 28.2 | 29.5 | 27.6 | 25.8 | 27.5 | 28.2 | 28.4 | 28.0 | 28.8 | 333.9 | 14 |
| | (at 0500 LST) | 27.1 | 24.2 | 28.1 | 27.8 | 30.1 | 29.1 | 27.7 | 28.5 | 28.0 | 27.5 | 28.1 | 28.1 | 334.3 | 14 |
| | (at 1100 LST) | 26.8 | 24.2 | 27.1 | 27.2 | 29.6 | 29.3 | 28.2 | 29.2 | 27.2 | 26.7 | 27.9 | 27.9 | 331.3 | 14 |

*Note: # = Less than 0.5 day; T = Trace; LST = Local Standard Time
+ = Data derived from records of nearby El Paso, Texas, station (31°48'N 106°24'W).

# H. CLIMATE (Continued)

**EPHEMERIS FOR FORT BLISS, TEXAS**

**(Mountain Standard Time)**

| | NAUTICAL TWILIGHT | | | |
|---|---|---|---|---|
| Date | Beginning | End | Sunrise | Sunset |
| January 1 | 0609 | 1810 | 0706 | 1713 |
| January 11 | 0610 | 1817 | 0707 | 1721 |
| January 21 | 0609 | 1825 | 0705 | 1730 |
| February 1 | 0604 | 1834 | 0659 | 1740 |
| February 11 | 0558 | 1842 | 0652 | 1749 |
| February 21 | 0549 | 1850 | 0642 | 1757 |
| March 1 | 0540 | 1856 | 0633 | 1803 |
| March 11 | 0529 | 1903 | 0621 | 1811 |
| March 21 | 0516 | 1910 | 0608 | 1818 |

| | NAUTICAL TWILIGHT | | | |
|---|---|---|---|---|
| Date | Beginning | End | Sunrise | Sunset |
| April 1 | 0501 | 1918 | 0554 | 1825 |
| April 11 | 0448 | 1926 | 0542 | 1832 |
| April 21 | 0435 | 1934 | 0530 | 1839 |
| May 1 | 0423 | 1943 | 0520 | 1846 |
| May 11 | 0413 | 1951 | 0512 | 1853 |
| May 21 | 0405 | 1959 | 0505 | 1859 |
| June 1 | 0359 | 2008 | 0501 | 1906 |
| June 11 | 0357 | 2013 | 0459 | 1911 |
| June 21 | 0357 | 2019 | 0500 | 1914 |

| | NAUTICAL TWILIGHT | | | |
|---|---|---|---|---|
| Date | Beginning | End | Sunrise | Sunset |
| July 1 | 0401 | 2018 | 0503 | 1915 |
| July 11 | 0406 | 2015 | 0508 | 1914 |
| July 21 | 0414 | 2010 | 0514 | 1910 |
| August 1 | 0422 | 2001 | 0521 | 1902 |
| August 11 | 0430 | 1950 | 0527 | 1853 |
| August 21 | 0438 | 1938 | 0534 | 1843 |
| September 1 | 0446 | 1924 | 0541 | 1830 |
| September 11 | 0453 | 1910 | 0547 | 1817 |
| September 21 | 0500 | 1857 | 0553 | 1804 |

| | NAUTICAL TWILIGHT | | | |
|---|---|---|---|---|
| Date | Beginning | End | Sunrise | Sunset |
| October 1 | 0507 | 1843 | 0559 | 1751 |
| October 11 | 0513 | 1831 | 0606 | 1738 |
| October 21 | 0520 | 1820 | 0613 | 1727 |
| November 1 | 0528 | 1810 | 0622 | 1716 |
| November 11 | 0535 | 1804 | 0630 | 1709 |
| November 21 | 0543 | 1759 | 0639 | 1704 |
| December 1 | 0551 | 1758 | 0648 | 1701 |
| December 11 | 0558 | 1759 | 0655 | 1702 |
| December 21 | 0604 | 1803 | 0702 | 1706 |

# I. CROSS-COUNTRY MOVEMENT

Cross-Country Movement (CCM) is defined as the off-road movement of military vehicles and personnel. The principal areal features that contribute to the cross-country movement rating of a terrain unit are soil type, state of ground (wet, dry, frozen), slope, vegetation, surface shape (rough, smooth, furrowed), and lakes and reservoirs. The principal linear features that affect cross-country movement are railroad and highway cuts and fills, drainageways, rivers, and streams. Natural and man-made features such as boulders, escarpments, and structures of all kinds also affect cross-country movement. The movement of different vehicles on the same terrain may be radically different, ranging from unable to travel for one vehicle to able to travel easily for another vehicle. The same terrain may afford different cross-country movement to the same vehicle at different times, depending, for example, on the time elapsed since the last rainfall. Driver skill and mechanical condition of the vehicle also can affect cross-country movement.

The principal feature that restricts choices of routes and limits speeds of advance at Fort Bliss is surface shape. In the context used herein, surface shape refers to such terrain features as the small stabilized dunes that occupy a significant proportion of the Tularosa Valley and the terrain roughness that exists wherever drainageways, thin soils, and exposed bedrock occur. In such areas it is the surface shape (not the soil, vegetation, or general slope) that forces vehicles and foot troops to move slowly and carefully.

Areas of loose, sandy soil reduce the maximum speeds of vehicles, but such areas can always be negotiated. In wet weather, which is rare and occurs mainly during the summer months, only a very few, small, widely-scattered areas become soft enough to affect CCM adversely. In some areas vegetation is better avoided than confronted but vegetation, per se, seldom causes immobilizations. Slopes do not immobilize vehicles, except in the extremely hilly to mountainous terrain, for elsewhere they seldom occur above 15 percent. There are no large lakes, rivers, or other significant natural or manmade barriers, except the Otero Mesa Escarpment, which is extremely steep.

In dry weather the broad, nearly flat Otero Mesa clearly provides the best CCM conditions at Fort Bliss. There are no obstacles on the mesa, soils are firm, and visibility is excellent. Vehicles and troops can move along any selected route safely at high speeds. The worst CCM conditions that still permit some movement occur at the toeslopes of mountains, around and on the slopes of isolated hillocks, and in certain locales within mountainous areas. Here, the rough, rocky surfaces, marred by many deeply-incised drainageways, severely limit choices of routes and speeds. Between these CCM extremes, travel is moderately to severely restricted. In the broad, wide waterways, floodplains, and playas that mark the last stages of drainage from the mountains into the Tularosa Valley, there are no boulders or rocks remaining, surfaces are generally smooth, drainageways are shallow, and vegetation is insignificant from a CCM standpoint. In most of this area, CCM is nearly as good as on Otero Mesa. In the Tularosa Valley, numerous dunes, irregular surfaces, and vegetation moderately restrict choices of routes and limit speeds, but never seriously threaten immobilization of vehicles. On alluvial fans and terraces adjacent to the toeslopes of mountains and escarpments, the surface roughness makes CCM nearly as poor as at the toeslopes of mountains, around and on the slopes of singular hills, and in certain locales within mountainous areas.

In wet weather, which affects CCM only a small percentage of the time, there is little degradation of soil strength except in those areas that contain silty or clayey soils and are not well drained. Such areas are more prevalent in the waterways, floodplains, and playas than elsewhere at Fort Bliss. However, even these areas must remain covered by water for several days before they become soft enough to cause serious degradation in CCM, which happens only infrequently. Such areas are easily recognized and usually can be avoided. Flooded conditions, which occasionally occur in the waterways, floodplains, and playas, also should be avoided.

The following table presents descriptions of the six terrain units that represent unique CCM conditions at Fort Bliss and evaluations of the movement of tracked and wheeled vehicles and foot troops in each. The units were derived from a comparison of the maps on Engineering Soils, Vegetation, and Surface Configuration and Drainage; recognition of meteorological factors; ground reconnaissance; helicopter reconnaissance; interviews with Fort Bliss personnel; and limited vehicle tests. The descriptions and evaluations reflect CCM conditions for general planning purposes.

| MAP UNIT | GENERAL TERRAIN CONDITIONS | MOVEMENT OF TRACKED VEHICLES[1] | MOVEMENT OF WHEELED VEHICLES[2] | MOVEMENT OF FOOT TROOPS |
|---|---|---|---|---|
| 1. Smooth, nearly flat tableland. | Broad, nearly flat to gently sloping uplands on the Otero Mesa, containing some small depressed areas. Slopes from 0 to 10 percent, but commonly 3 to 5 percent. Soils mainly silty sands (SM), silty gravels (GM), and silts (ML). Vegetation is short grasses and surface configuration is nearly equally divided between low plains and high plains. Although most rain remains essentially where it falls, some surface water drains from this unit, mostly southeastward along the El Paso Draw. Area of unit is 377.4 km² (145.6 mi²). | In dry weather vehicles can move freely in any direction at speeds[3] of at least 32 kmph (20 mph) on smooth, firm soils. Moderate dust clouds are raised.<br><br>In wet weather small, widely scattered areas[4] of silty or clayey soils that are not well drained sometimes become soft enough to degrade CCM. These areas are easily recognized and can be avoided. Usually such areas can be traversed by tracked vehicles, but movement in trace is not recommended. Except for the need to avoid these areas, CCM in wet weather is as good as in dry weather. | In dry weather vehicles can move freely in any direction at speeds of at least 32 kmph (20 mph) along any chosen route, except in small, widely-scattered areas[5] of clayey surface soils that may be rough and uneven on the surface. Such areas are not numerous in this unit and are usually small in size. When encountered, however, they often cause wheeled vehicles to slow down to avoid excessive vibration. Moderate dust clouds are raised in dry weather.<br><br>In wet weather certain areas[4] effectively prohibit wheeled vehicle travel, but otherwise vehicles can move freely at speeds of 32 kmph (20 mph) or greater. | Foot troops encounter no difficulty in dry weather except when high winds raise dust and blowing sand. In wet weather, certain areas[4] constitute minor nuisances to foot troops but do not significantly affect their speed of advance. |
| 2. Nearly flat to concave shallow depressions, broad floodplains, playas, and wide waterways. | Shallow depressions, broad floodplains, playas, and wide waterways in the Tularosa Valley and on Otero Mesa. Slopes nearly flat to concave in the 0 to 2 percent range. Mainly silty soils (ML), occasionally lean clays (CL). Predominant vegetation is short grasses, but evergreen scrub also occurs. Surface configuration is mainly low plains. Flooding for short periods may occur during and following heavy rains. Depressions retain water for short periods following heavy rains; some become cracked and rough on the surface when dry. Area of unit is 536 km² (207 mi²). | In dry weather tracked vehicles can move freely on surfaces only slightly less smooth than those of CCM Map Unit 1, at speeds up to 32 kmph (20 mph). Dust clouds are created.<br><br>In wet weather flooding prohibits vehicular movement for the actual period of flooding, but only depressions[4] that retain water on the surface become soft enough to threaten vehicle passage for several days. Attempts to cross such areas (many wet-looking areas will be trafficable) should not be made unless another vehicle is available for retrieval. Movement of vehicles in trace should not be attempted. | In dry weather wheeled vehicles can move freely over most surfaces at speeds up to 32 kmph (20 mph), except in isolated depressions with severe surface cracks.[5] Dust clouds are created. Areas of dense scrub sometimes decrease speeds to 16 kmph (10 mph), restrict choices of routes, and create some risk of tire puncture and injury to personnel.<br><br>In wet weather, during flooding, vehicular movement is prohibited, but depressed areas[4] become soft enough to immobilize vehicles for several days after rains. Such areas should be avoided. | Foot troops encounter no difficulty in dry weather except when high winds raise dust. In wet weather, certain areas[4] constitute minor nuisances to foot troops, but do not significantly affect the speed of their advance. |
| 3. Gently sloping outwash plains and relic lake beds containing many dunes. | Gently sloping to undulating outwash plains and relic lake beds in the intermountain basin. Slopes under 5 percent. Soils mainly fine sands (SP), occasionally silty sands (SM), clayey sands (SC), silts (ML) and lean clays (CL). Largely covered by coppice dunes, but also contains sizable duneless areas. Surface configuration is low plains. Rainfall in surrounding mountains drains into this unit, but no significant amount leaves it.<br><br>In duned areas vegetation is mainly deciduous scrub. Dune heights range from 1 m to 4 m (3 to 12 ft), averaging 2 m (5 ft); dunes spaced base to base from 4 to 31 m (12 to 100 ft), averaging 12 m (40 ft). Surface between dunes smooth and slightly concave.<br><br>In duneless areas vegetation is evergreen scrub, short grasses, or insignificant to lacking. Surface is usually irregular, with small local drainageways. Small depressions occur infrequently. Area of unit is 2082.5 km² (804 mi²). | Conditions moderately hinder progress or restrict choices of direction. In duned areas loose soil reduces traction and forms dust clouds and blowing sand under traffic or in high winds. Dunes restrict visibility and force vehicles into circuitous courses. The closer the dunes are spaced, the greater is the detrimental effect on speed of advance. Backtracking[6] is occasionally required. Vehicles average speeds of about 13 kmph (8 mph). Many vehicles in trace and much maneuvering is possible. Wet weather actually improves CCM by decreasing dust and increasing traction somewhat.<br><br>In duneless areas loose soil, tall vegetation (where it exists), somewhat rough surfaces, and shallow drainageways combine to restrict choices of routes and reduce speeds. Visibility is better in duneless areas and average speeds of 16 kmph (10 mph) can be made. Soils will support many vehicles in trace and much maneuvering. Wet weather has no significant effect on CCM except in small, widely scattered areas[4] where it places limitations on vehicles in trace and maneuvering. | Conditions moderately hinder progress or restrict choices of direction. In duned areas loose sand, dunes, and thorny vegetation are deterrents. Reduction of traction is more severe than for tracked vehicles. Circuitous routing is often necessary. Dust clouds are raised and visibility is worse than for tracked vehicles because of the lower elevation of the wheeled-vehicle drivers. Thorny vegetation, which has no effect on tracked vehicles, must be avoided as a hazard to tires and personnel. Backtracking is sometimes necessary. Average speed is about 10 kmph (6 mph). Terrain supports many vehicles in trace and much maneuvering. Wet weather improves CCM somewhat.<br><br>In duneless areas loose sand, thorny vegetation (where it exists), rough surfaces and small drainageways slow down speeds and restrict choices of routes. Speeds average about 11 kmph (7 mph). Soils will support many vehicles in trace and much maneuvering. Dust clouds are raised. Wet weather adversely affects CCM only in widely scattered, small depressions[4]. Such depressions should be avoided. | Loose soils cause moderate difficulty in walking and discomfort of personnel during high winds. Dunes add extra distance to journeys. Thorny vegetation can cause painful injuries. Rough surfaces and drainageways increase walking difficulty somewhat. |
| 4. Sloping alluvial fans, pediments, and terraces adjacent to mountains and mesa escarpments. | Undulating to sloping alluvial fans, pediments, and terraces adjacent to mountains and mesa escarpments. Slopes generally 5 to 8 percent, with 3 to 15 percent range. Surface contains short complex slopes and numerous dissections by drainageways. Soils are silty sands (SM) and silty gravels (GM), well drained. Predominant vegetation is evergreen scrub, medium to dense spacing. Surface configuration is mainly low plains, but with some high plains adjacent to the Otero Mesa. The unit is an active drainage zone for rainfall in the mountains. Area of unit is 468.6 km² (181 mi²). | Speed and choice of routes are severely restricted by drainageways, rough surfaces, short complex slopes, and vegetation. Some portions of upper reaches of drainageways are too deep and wide for safe vehicle crossings, but crossings within the unit can be found by backtracking. Near upper reaches of drainageways, vehicles can travel perpendicular to drainageways at speeds of about 6 kmph (4 mph). Near lower reaches speeds are somewhat higher. Parallel to drainageways speeds can reach about 10 kmph (6 mph). Soils, even when wet, will support many vehicles in trace and permit much maneuvering. Some dust is raised in dry weather.<br><br>This unit is not recommended for training exercises in which significant movement of tracked vehicles is required. | Speed and choice of routes are severely restricted by drainageways, rough surfaces, short complex slopes, and vegetation. Thorny vegetation is hazardous to tires and M-151 personnel. Upper reaches of drainageways contain sections that prohibit vehicle crossings, but crossings can be found by backtracking. Average speed perpendicular to drainageways in upper reaches is 5 kmph (3 mph), in lower reaches 6 kmph (4 mph). Parallel to drainageways vehicles can move at average speeds of 8 kmph (5 mph). Soils, even when wet, will support many vehicles in trace and permit much maneuvering. Some dust is raised in dry weather.<br><br>This unit is not recommended for training exercises in which significant movement of wheeled vehicles is required. | The combination of rough surfaces, drainageways, and vegetation moderately affects troop movement. Troops cannot walk in straight lines for any appreciable distance. |
| 5. Rock outcrops, bedrock-controlled plateaus, pediment slopes, hills, and moderately sloping areas within mountains. | Gently sloping to moderately steep rock outcrops, bedrock-controlled plateaus, pediment slopes at bases of mountains, isolated rounded to oval-shaped hills, and canyons and other areas of relatively moderate slopes enclosed by steeper, more rugged mountainous areas. Surface contains boulders, short complex slopes, and deeply-incised drainageways. Slopes range from 1 to 18 percent, but are mainly between 5 and 12 percent. Soils are mainly silty gravels (GM) and clayey gravels (GC). Vegetation is mainly evergreen scrub and short grasses. Surface configuration is mainly low plains and high plains, but low hills occur along the eastern edge of the Organ Mountains. Area of unit is 448 km² (173 mi²). | Conditions severely hinder progress or greatly restrict choice of routes; the extremely rough nature of the surface in this unit, rather than the steepness of the slopes, is the controlling factor. In the less severely dissected areas of this unit, vehicles can move at average speeds of about 10 kmph (6 mph); in the worst areas, average speed is about 3 kmph (2 mph). Overall average speed is about 5 kmph (3 mph). Extreme care must be exercised constantly to avoid boulders, local complex-slope situations, and deep gullies. Much backtracking is required in CCM operations in this unit. Surfaces are firm all year round and permit many vehicles to operate in trace and much maneuvering. Vegetation does not appreciably hinder tracked vehicle movement.<br><br>This unit is not recommended for training exercises in which significant movement of tracked vehicles is required. | Speed and choice of routes severely restricted. Wheeled vehicles can negotiate this unit, but constant vigilance and considerable backtracking is required to avoid complex slope situations, boulders, gullies, and vegetation. In the smoother portions of this very rough unit, wheeled vehicles can average speeds of about 10 kmph (6 mph); in the rougher portions average speeds will be reduced to about 3 kmph (2 mph). The average speed in the unit as a whole is about 5 kmph (3 mph). Vehicles can move in trace and maneuvering can be accomplished at any time. Wet weather will have no appreciable effect on the CCM rating of this unit.<br><br>This unit is not recommended for training exercises in which significant movement of wheeled vehicles is required. | Foot troops will find it moderately difficult to advance rapidly because of the ruggedness of the surface and the thorny vegetation. |
| 6. Extremely hilly to mountainous terrain. | Extremely hilly to mountainous terrain. Slopes normally exceed 20 percent and are in many cases vertical. Surfaces are rough, much bedrock is exposed. The thin soils that occur are silty gravels (GM) and clayey gravels (GC) containing cobbles. Surface configuration is mainly high plains, low hills, and high hills, with a large area of mountains in the Organ Mountains and smaller areas in the Sacramento Mountains. Area of unit is 606 km² (234 mi²). | Unsuited; steep slopes and extremely rugged terrain prohibit the movement of tracked vehicles. | Unsuited; steep slopes and extremely rugged terrain prohibit the movement of wheeled vehicles. | Only specially-trained, properly-equipped troops can move safely. Speed of advance is very slow. |

[1]Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).
[2]Comments apply to the M-35 2½-ton truck and the M-151 ¼-ton truck.
[3]Vehicle speeds quoted are ground speeds measured in tests conducted especially for this study. A test consisted of driving a vehicle in the straightest line feasible at the fastest speed consistent with the safety of the vehicle and the comfort and safety of the driver and passengers. These criteria were meant to represent the driving conditions that would obtain in a normal, routine exercise where a reasonable rate of march was expected but where unnecessary risks to vehicles or personnel were not permitted.
[4]The level of generalization necessarily used in this study does not permit the specification of the locations of such areas. In the field they are recognizable as water-covered areas or by their relatively dark color following rains.
[5]In dry weather, those depressed areas that contain a significant amount of clay may shrink and crack on the surface, creating microrelief so rough it forces drastic reduction of the speeds of wheeled vehicles. The intensity of the cracking depends on the antecedent conditions (history of wetting, drying, freezing, thawing); it may vary from year to year at the same location. In January 1978 at Old Coe Lake (grid reference 693670) the M-151 and the M-35 could not travel faster than 6 kmph (4 mph) without violent vibration. The M-60 and the M-113, on the other hand, were easily able to travel at speeds of nearly 32 kmph (20 mph).
[6]Backtracking is defined as stopping because of an obstacle, backing up, and then proceeding forward or laterally on a new path.

JOINS MAP 2

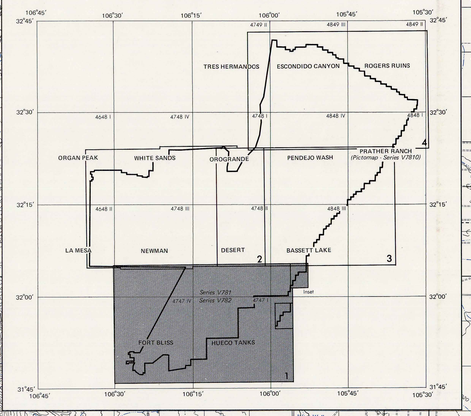
JOINS MAP 3

JOINS INSET

JOINS MAP 3

JOINS MAP 1

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TULAROSA VALLEY

FRANKLIN MOUNTAINS

HUECO MOUNTAINS

MCGREGOR GUIDED MISSILE RANGE

MISSILE RANGE BOUNDARY

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

MCGREGOR RANGE CAMP

NEW MEXICO
TEXAS

OTERO COUNTY
EL PASO COUNTY

FORT BLISS MILITARY RESERVATION

BIGGS FIELD

MAIN CANTONMENT AREAS

EL PASO

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY
CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement (CCM), or movement off roads. This map is primarily intended as a tool for planning military operations or determining the availability of appropriate terrain for training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or foot troops. An area marked with a specific CCM evaluation may contain areas too small to be mapped that have better or worse ratings. the significant occurrence of such cases is noted in the table on the preceding page.

Only 203mm (8 in.) of rain falls on Fort Bliss annually. More than half of this occurs in July, August, and September. Low total rainfall distributed over many days, high evapotranspiration rates, moderately good surface drainage, and moderate to rapid permeabilities of the mainly sandy soils result in the soils at Fort Bliss rarely becoming wet enough to create CCM problems. Therefore, for all practical purposes, the CCM ratings shown in this map may be considered to apply all year round. Exceptions, which occur when heavy rainstorms fall on poorly-drained soils containing significant amounts of silt or clay, are noted in the table on the preceding page. Only 127mm (5 in.) of snow falls at Fort Bliss annually. Snow is therefore not a deterrent to CCM at Fort Bliss. Moderate to high winds occurring frequently throughout the year raise dust and blowing sand, to the detriment of CCM.

EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

| MAP UNIT | TERRAIN UNIT | PREDICTED MOVEMENT RATINGS FOR: TANK (M-60) | APC (M-113) | 2½ TON TRUCK (M-35) | ¼ TON TRUCK (M-151) | FOOT TROOPS |
|---|---|---|---|---|---|---|
| 1. | Smooth, nearly flat tableland. | Good | Good | Good | Good | Good |
| 2. | Nearly flat to concave shallow depressions, broad flood plains, playas,and wide waterways. | Good | Good | Good | Good | Good |
| 3. | Gently sloping outwash plains and relic lake beds containing many dunes. | Fair | Fair | Fair | Fair | Fair |
| 4. | Sloping alluvial fans, pediments, and terraces adjacent to hills, mountains, and mesa escarpments. | Poor | Poor | Poor | Poor | Fair |
| 5. | Rock outcrops, bedrock-controlled plateaus, pediment slopes, hills, and moderately sloping areas within mountains. | Poor | Poor | Poor | Poor | Fair |
| 6. | Extremely hilly to mountainous terrain. | Unsuited | Unsuited | Unsuited | Unsuited | Poor |

EXPLANATION OF RATING TERMS

Good — Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

Fair — Conditions moderately hinder progress or moderately restrict choices of direction for movement or terrain will permit only 3 to 12 passes in trace of an M-60 and maneuvering will be difficult.

Poor — Conditions severely hinder progress or greatly restrict choice of movement routes or terrain will not permit maneuvering nor more than 3 passes in trace of an M-60. Very cautious driving required.

Unsuited — Conditions preclude all but local movement. Engineer work required for vehicular movement.

NOTE: Number refers to entry in table.

Impact area, range fan, and missile range boundaries. Impact area is off limits to vehicles and foot troops due to the danger of unexploded munitions.

Cantonment area (not evaluated)

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

WHITE SANDS MISSILE RANGE

JOINS MAP 4

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST-STAGE IMPACT AREA

(TEMPORARY CLOSINGS ONLY)

DONA ANA IMPACT AREA

TULAROSA VALLEY

ORGAN MOUNTAINS

DONA ANA COUNTY

OTERO COUNTY

OROGRANDE RANGE CAMP

DONA ANA RANGE CAMP

PERSHING FIRING FAN

(TEMPORARY CLOSINGS ONLY)

JOINS MAP 3

JOINS MAP 1

Scale 1:50,000

CONTOUR INTERVAL 40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

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TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS · ORGAN PEAK · WHITE SANDS · OROGRANDE · PENDEJO WASH · PRATHER RANCH (Pictomap - Series V7810) · LA MESA · NEWMAN · DESERT · BASSETT LAKE · FORT BLISS · HUECO TANKS

Series V781
Series V782

# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement (CCM), or movement off roads. This map is primarily intended as a tool for planning military operations or determining the availability of appropriate terrain for training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or foot troops. An area marked with a specific CCM evaluation may contain areas too small to be mapped that have better or worse ratings; the significant occurrence of such cases is noted in the table on the preceding page.

Only 203mm (8 in ) of rain falls on Fort Bliss annually. More than half of this occurs in July, August, and September. Low total rainfall distributed over many days, high evapotranspiration rates, moderately good surface drainage, and moderate to rapid permeabilities of the mainly sandy soils result in the soils at Fort Bliss rarely becoming wet enough to create CCM problems. Therefore, for all practical purposes, the CCM ratings shown in this map may be considered to apply all year round. Exceptions, which occur when heavy rainstorms fall on poorly-drained soils containing significant amounts of silt or clay, are noted in the table on the preceding page. Only 127mm (5 in ) of snow falls at Fort Bliss annually. Snow is therefore not a deterrent to CCM at Fort Bliss. Moderate to high winds occurring frequently throughout the year raise dust and blowing sand, to the detriment of CCM.

EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

| MAP UNIT | TERRAIN UNIT | PREDICTED MOVEMENT RATINGS FOR: TANK (M-60) | APC (M-113) | 2½ TON TRUCK (M-35) | ¼ TON TRUCK (M-151) | FOOT TROOPS |
|---|---|---|---|---|---|---|
| Does not appear on this map | 1. Smooth, nearly flat tableland. | Good | Good | Good | Good | Good |
| | 2. Nearly flat to concave shallow depressions, broad flood plains, playas, and wide waterways. | Good | Good | Good | Good | Good |
| | 3. Gently sloping outwash plains and relic lake beds containing many dunes. | Fair | Fair | Fair | Fair | Fair |
| | 4. Sloping alluvial fans, pediments, and terraces adjacent to hills, mountains, and mesa escarpments. | Poor | Poor | Poor | Poor | Fair |
| | 5. Rock outcrops, bedrock-controlled plateaux, pediment slopes, hills, and moderately sloping areas within mountains. | Poor | Poor | Poor | Poor | Fair |
| | 6. Extremely hilly to mountainous terrain. | Unsuited | Unsuited | Unsuited | Unsuited | Poor |

EXPLANATION OF RATING TERMS

Good — Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

Fair — Conditions moderately hinder progress or moderately restrict choices of direction for movement or terrain will permit only 3 to 12 passes in trace of an M-60 and maneuvering will be difficult.

Poor — Conditions severely hinder progress or greatly restrict choice of movement routes or terrain will not permit maneuvering nor more than 3 passes in trace of an M-60. Very cautious driving required.

Unsuited — Conditions preclude all but local movement. Engineer work required for vehicular movement.

NOTE: Number refers to entry in table.

Impact area, range fan, and missile range boundaries. Impact area is off limits to vehicles and foot troops due to the danger of unexploded munitions.

Cantonment area (not evaluated)

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST-STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

OTERO MESA

HUECO MOUNTAINS

MISSILE RANGE BOUNDARY

MIL RES

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TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
OROGRANDE
PENDEJO WASH
PRATHER RANCH (Pricompan Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782
Inset

Scale 1:50,000

CONTOUR INTERVAL

Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheets 4848 III, 4848 IV
50 FEET

# MAP 3

# FORT BLISS, TEXAS TERRAIN ANALYSIS

## CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement (CCM), or movement off roads. This map is primarily intended as a tool for planning military operations or determining the availability of appropriate terrain for training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or foot troops. An area marked with a specific CCM evaluation may contain areas too small to be mapped that have better or worse ratings; the significant occurrence of such cases is noted in the table on the preceding page.

Only 203mm (8 in.) of rain falls on Fort Bliss annually. More than half of this occurs in July, August, and September. Low total rainfall distributed over many days, high evapotranspiration rates, moderately good surface drainage, and moderate to rapid permeabilities of the mainly sandy soils result in the soils at Fort Bliss rarely becoming wet enough to create CCM problems. Therefore, for all practical purposes, the CCM ratings shown in this map may be considered to apply all year round. Exceptions, which occur when heavy rainstorms fall on poorly-drained soils containing significant amounts of silt or clay, are noted in the table on the preceding page. Only 127mm (5 in.) of snow falls at Fort Bliss annually. Snow is therefore not a deterrent to CCM at Fort Bliss. Moderate to high winds occurring frequently throughout the year raise dust and blowing sand, to the detriment of CCM.

### EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

| MAP UNIT | TERRAIN UNIT | PREDICTED MOVEMENT RATINGS FOR: TANK (M-60) | APC (M-113) | 2½ TON TRUCK (M-35) | ¼ TON TRUCK (M-151) | FOOT TROOPS |
|---|---|---|---|---|---|---|
| 1. | Smooth, nearly flat tableland. | Good | Good | Good | Good | Good |
| 2. | Nearly flat to concave shallow depressions, broad flood plains, playas, and wide waterways. | Good | Good | Good | Good | Good |
| 3. | Gently sloping outwash plains and relic lake beds containing many dunes. | Fair | Fair | Fair | Fair | Fair |
| 4. | Sloping alluvial fans, pediments, and terraces adjacent to hills, mountains, and mesa escarpments. | Poor | Poor | Poor | Poor | Fair |
| 5. | Rock outcrops, bedrock-controlled plateaus, pediment slopes, hills, and moderately sloping areas within mountains. | Poor | Poor | Poor | Poor | Fair |
| 6. | Extremely hilly to mountainous terrain. | Unsuited | Unsuited | Unsuited | Unsuited | Poor |

### EXPLANATION OF RATING TERMS

| | |
|---|---|
| Good | Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location. |
| Fair | Conditions moderately hinder progress or moderately restrict choices of direction for movement or terrain will permit only 3 to 12 passes in trace of an M-60 and maneuvering will be difficult. |
| Poor | Conditions severely hinder progress or greatly restrict choice of movement routes or terrain will not permit maneuvering nor more than 3 passes in trace of an M-60. Very cautious driving required. |
| Unsuited | Conditions preclude all but local movement. Engineer work required for vehicular movement. |

NOTE: Number refers to entry in table.

Does not appear on this map

Impact area, range fan, and missile range boundaries. Impact area is off limits to vehicles and foot troops due to the danger of unexploded munitions.

Cantonment area (not evaluated)

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement (CCM), or movement off roads. This map is primarily intended as a tool for planning military operations or determining the availability of appropriate terrain for training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or foot troops. An area marked with a specific CCM evaluation may contain areas too small to be mapped that have better or worse ratings; the significant occurrence of such cases is noted in the table on the preceding page.
Only 203mm (8 in.) of rain falls on Fort Bliss annually. More than half of this occurs in July, August, and September. Low total rainfall distributed over many days, high evapotranspiration rates, moderately good surface drainage, and moderate to rapid permeabilities of the mainly sandy soils result in the soils at Fort Bliss rarely becoming wet enough to create CCM problems. Therefore, for all practical purposes, the CCM ratings shown in this map may be considered to apply all year round. Exceptions, which occur when heavy rainstorms fall on poorly-drained soils containing significant amounts of silt or clay, are noted in the table on the preceding page. Only 127mm (5 in.) of snow falls at Fort Bliss annually. Snow is therefore not a deterrent to CCM at Fort Bliss. Moderate to high winds occurring frequently throughout the year raise dust and blowing sand, to the detriment of CCM.

### EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

| MAP UNIT | TERRAIN UNIT | PREDICTED MOVEMENT RATINGS FOR: TANK (M-60) | APC (M-113) | 2½ TON TRUCK (M-35) | ¼ TON TRUCK (M-151) | FOOT TROOPS |
|---|---|---|---|---|---|---|
| 1. | Smooth, nearly flat tableland. | Good | Good | Good | Good | Good |
| 2. | Nearly flat to concave shallow depressions, broad flood plains, playas, and wide waterways. | Good | Good | Good | Good | Good |
| 3. | Gently sloping outwash plains and relic lake beds containing many dunes. | Fair | Fair | Fair | Fair | Fair |
| 4. | Sloping alluvial fans, pediments, and terraces adjacent to hills, mountains, and mesa escarpments. | Poor | Poor | Poor | Poor | Fair |
| 5. | Rock outcrops, bedrock-controlled plateaus, pediment slopes, hills, and moderately sloping areas within mountains. | Poor | Poor | Poor | Poor | Fair |
| 6. | Extremely hilly to mountainous terrain. | Unsuited | Unsuited | Unsuited | Unsuited | Poor |

### EXPLANATION OF RATING TERMS

**Good** Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

**Fair** Conditions moderately hinder progress or moderately restrict choices of direction for movement or terrain will permit only 3 to 12 passes in trace of an M-60 and maneuvering will be difficult.

**Poor** Conditions severely hinder progress or greatly restrict choice of movement routes or terrain will not permit maneuvering nor more than 3 passes in trace of an M-60. Very cautious driving required.

**Unsuited** Conditions preclude all but local movement. Engineer work required for vehicular movement.

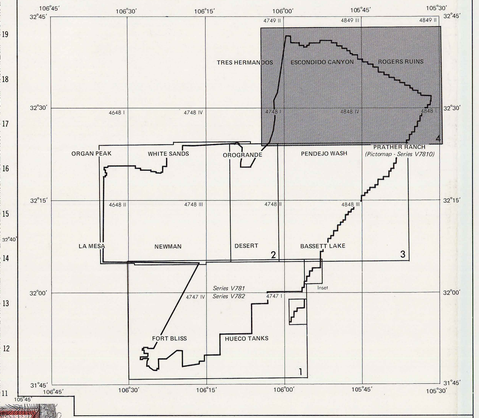
NOTE: Number refers to entry in table.

Impact area, range fan, and missile range boundaries. Impact area is off limits to vehicles and foot troops due to the danger of unexploded munitions.

Does not appear on this map — Cantonment area (not evaluated)

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

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Scale 1:50,000

CONTOUR INTERVAL

**Sheet 4748 I**
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

**Sheet 4749 II**
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

**Sheet 4848 I**
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

**Sheet 4849 II**
40 FEET

**Sheets 4848 IV, 4849 III**
50 FEET

JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# J. LINES OF COMMUNICATION

## I. ROADS

The number and condition of roads on Fort Bliss make vehicular movement difficult and time-consuming in many areas, particularly in the large area of the McGregor Guided Missile Range. There are no major east-west hard surfaced roads crossing the reservation and only one north-south road, US Route 54.

There are approximately 2792 kilometers (1735 miles) of roads on Fort Bliss. Of this total, 184 kilometers (114 miles) are all weather hard surfaced, 1492 kilometers (927 miles) are fair weather improved dirt surfaced, 818 kilometers (508 miles) are unimproved dirt surfaced, and 298 kilometers (185 miles) are tank trails.

Most of the hard surfaced roads are in the cantonment areas. US Route 54, in an easement across the reservation, runs north-south and provides access to lateral routes; tracked vehicles are permitted to cross it at only two places. New Mexico Highway 213 (War Highway 11) serves the northwestern part of Fort Bliss. Grades are low and curves are gradual on most surfaced roads.

Fair weather improved dirt roads are generally trafficable throughout the year because of the extremely low regional rainfall. Ephemeral lakes, such as the one at grid reference 077977 (map sheet 4) fill so seldomly that roads cross them.

Unimproved dirt roads require frequent realinement because shifting sand frequently covers portions of them. The alinements shown on the accompanying maps should be considered to be approximate in areas of little relief. Unmaintained roads are in poor condition. Four-wheel-drive vehicles are recommended for most unimproved roads, and for some improved dirt roads.

Tank travel outside of designated maneuver areas is only on specified tank trails. Wheeled vehicles are permitted on tank trails.

Some roads on Fort Bliss have been constructed, improved, and/or maintained by White Sands Missile Range, Bureau of Land Management, Hot Wells Ranch, El Paso Natural Gas Company, Standard Oil of Texas, US Forest Service, Southern Pacific Transportation Company, and others. Some of these roads do not have designated route numbers. Because of various real estate agreements, Fort Bliss maintains certain roads outside the reservation.

Some reservation numbered routes do not appear in the table below because they are within the cantonment areas, are not of significant length, or are not described sufficiently in the real estate records to be accurately identified. Some routes, including tank trails, are not shown in their entirety on the accompanying maps because they leave the reservation at various places.

| ROUTE NUMBER/NAME | ROUTE LOCATION (GRID REFERENCE) FROM | TO | MAP SHEET | LENGTH OF SEGMENT* | MILITARY LOAD CLASSIFICATION | ROUTE TYPE | SURFACE CONSTRUCTION MATERIALS | SURFACE WIDTH/CONDITION* | SHOULDER CONSTRUCTION MATERIALS | SHOULDER WIDTH/CONDITION* | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hard surfaced, named or numbered roads: | | | | | | | | | | | |
| Airport Road | 655218 | 671211 | 1 | 2.2 km (1.4 mi) | No data | All weather | Asphalt | 21.9 m (72 ft)/good | Bituminous | 3 m (10 ft)/good | Six lanes, owned by the City of El Paso. Runs in an easement and is included for completeness. Tank crossings are at 660219 and 671211. |
| Carter Road | 640191 | 659197 | 1 | 2.4 km (1.5 mi) | No data | All weather | Asphalt | 5.8 to 7.9 m (19 to 26 ft) /good | No shoulders | Curbed and guttered | Two lanes, includes small portion of Pershing Circle and Pershing Drive to show connection with off-post route. |
| Dyer Street | 633214 | 638247 | 1 | 2.4 km (1.5 mi) | No data | All weather | Asphalt | 14.6 m (48 ft)/fair | No shoulders | Curbed and guttered | Four lanes, dual, owned by the City of El Paso, formerly route US 54. Runs in an easement through two parts of the reservation and is included for completeness. |
| F Road | 895488 | 903488 | 1 | 0.8 km (0.5 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/fair | Gravel | 2.4 m (8 ft)/fair | Two lanes |
| Forrest Road | 636200 | 671203 | 1 | 3.7 km (2.3 mi) | No data | All weather | Asphalt | 7.3 to 14.6 m (24 to 48 ft)/good | No shoulders | Curbed and guttered | Two and four lanes, includes Tompkins Avenue to show connection with off-post route. |
| Haan Road | 640210 | 670210 | 1 | 3 km (1.9 mi) | No data | All weather | Asphalt | 7.3 to 14.6 m (24 to 48 ft)/ fair | No shoulders | Curbed and guttered | Two and four lanes |
| Hawk Street | 890497 | 934505 | 1 | 4.3 km (2.7 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/excellent | Bituminous | 2.4 m (8 ft)/good | Two lanes |
| IFC Road | 931454 | 876545 | 1-2 | 11.2 km (7 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/fair | Dirt | 2.4 m (8 ft)/fair | Two lanes |
| Jeb Stuart Road | 658177 | 655218 | 1 | 4.3 km (2.7 mi) | No data | All weather | Asphalt | 7.9 to 15.2 m (26 to 50 ft)/good | No shoulders | Curbed and guttered | Two and four lanes |
| Launcher Road | 954471 | 897549 | 1-2-3 | 10.5 km (6.5 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/fair | Dirt | 2.4 m (8 ft)/fair | Two lanes |
| Launcher Site Road | 981818 | 992798 | 2-3 | 2.2 km (1.4 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/good | Dirt | 2.4 m (8 ft)/fair | Two lanes; tank crossing point at 981818, not described elsewhere; crosses Southern Pacific Railroad main line single track and siding, standard gage, 1.44 m (4 ft 8.5 in), slag ballast, 4.9 m (16 ft) between lines, rail weight 55.9 kg/m (113 lb/yd); also crosses Southern Pacific Transportation Company petroleum products pipeline, diameter 15.2 cm (6 in), depth underground approximately 1.5 m (5 ft). These items are in an easement at the west end of the road and are not government property. |
| Marshall Road | 646204 | 646218 | 1 | 1.5 km (0.9 mi) | No data | All weather | Asphalt | 14.6 m (48 ft)/good | No shoulders | Curbed and guttered | Four lanes |
| McGregor Range Main Road | 799496 | 890497 | 1 | 9.5 km (5.9 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/excellent | Bituminous | 2.4 m (8 ft)/good | Two lanes; tank crossing point, not described elsewhere, crosses at 880497 at the southern end of McGregor Range Route 9. |
| Meyer Range Road | 934413 | 939456 | 1 | 5.8 km (3.6 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/good | Dirt | 2.4 m (8 ft)/good | Two lanes |
| Orogrande Range Camp Road | 754854 | 922854 | 2-3 | 16.9 km (10.5 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/fair | Dirt | 2.4 m (8 ft)/good | Two lanes |
| Ricker Road | 655203 | 670188 | 1 | 2.2 km (1.4 mi) | No data | All weather | Asphalt | 6.7 to 7.9 m (22 to 26 ft) /excellent | Bituminous | 3 m (10 ft)/excellent | Two lanes |
| Sheridan Road | 640212 | 655189 | 1 | 2.1 km (1.3 mi) | No data | All weather | Asphalt | 12.2 to 15.8 m (40 to 52 ft)/fair | No shoulders | Curbed and guttered | Four lanes, partially dual |
| Fort Bliss #2** | 752413 | 888491 | 1 | 17.6 km (10.9 mi) | No data | All weather | Bituminous; caliche and dirt | 7.3 to 11 m (24 to 36 ft) /good | Gravel | 2.4 m (8 ft)/good | Two lanes, known locally as Pole Line Road, McGregor Range South Access Road, and Meyer Range West Access Road. Paved from 751412 to 800440. |
| Fort Bliss #3** | 817496 | 817479 | 1 | 1.7 km (1.1 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/good | Gravel | 2.4 m (8 ft)/good | Two lanes |
| 5th Street | 895497 | 895488 | 1 | 0.9 km (0.6 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/fair | Gravel | 2.4 m (8 ft)/fair | Two lanes |
| 13th Road | 904497 | 903488 | 1 | 0.7 km (0.4 mi) | No data | All weather | Asphalt | 7.3 m (24 ft)/fair | Gravel | 2.4 m (8 ft)/fair | Two lanes |
| Fort Bliss #13** | 792500 | 716535 | 1-2 | 6 km (3.7 mi) | No data | All weather | Asphalt | 6.1 m (20 ft)/good | Gravel | 2.4 m (8 ft)/good | Two lanes, also known as Hueco Range Access Road and as Tie Line Road; tank trail 94 parallels south side. |
| Fort Bliss #24** | 981818 | 058840 | 2-3 | 6.5 km (4 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/good | Gravel | 2.4 m (8 ft)/good | Two lanes |
| US 54 | 639214 | 638244 | 1 | 1.9 km (1.2 mi) | No data | All weather | Asphalt | 21.9 m (72 ft) /excellent | No shoulders | Curbed and guttered | Six lanes, dual, owned by the City of El Paso, also known as Gateway North, follows former Sheridan Avenue alinement, runs in an easement through two parts of the reservation and is included for completeness. |
| Fort Bliss #86** | 984814 | 988814 | 2-3 | 0.4 km (0.2 mi) | No data | All weather | Bituminous | 6.1 m (20 ft)/good | Gravel | 2.4 m (8 ft)/good | Two lanes |
| Fort Bliss #91** | 799440 | 923440 | 1 | 12.3 km (7.6 mi) | No data | All weather | Bituminous | 7.3 m (24 ft)/good | Gravel | 2.4 m (8 ft)/good | Two lanes, also known as part of Meyer Range Access Road. |
| New Mexico 213 | 600503 | 670776 | 1-2 | 36.7 km (22.8 mi) | No data | All weather | Asphalt | 7.3 to 9.1 m (24 to 30 ft) /excellent | Gravel | 2.4 m (8 ft)/good | Two lanes, usually referred to locally by its old name, War Highway 11, also known as White Sands Missile Range Road (WSMR Road). Tank crossing points are located at 599508, 585574, 681569, and 682736. |
| Improved dirt-surfaced, named or numbered roads: | | | | | | | | | | | |
| Dell City Cut-Off | 372917 | 401806 | 3-4 | 12 km (7.5 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #3 | 751411 | 930412 | 1 | 17.5 km (10.9 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #4 | 768191 | 826411 | 1 | 20.9 km (13 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #4** | 903488 | 864410 | 1 | 10.1 km (6.3 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #5 | 866292 | 930412 | 1 | 13.7 km (8.5 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #6 | 867292 | 930412 | 1 | 17.2 km (10.7 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #6** | 888493 | 892440 | 1 | 5.5 km (3.4 mi) | No data | Fair weather | Dirt | 4.3 m (14 ft)/poor | No shoulders | No shoulders | One lane, not maintained |
| Fort Bliss #7 | 722361 | 865291 | 1 | 16.3 km (10.1 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #8 | 750347 | 796227 | 1 | 13.5 km (8.4 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #9** | 888497 | 888504 | 1 | 0.7 km (0.4 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #10 | 706219 | 864290 | 1 | 14.6 km (9.1 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #10** | 898497 | 898504 | 1 | 0.7 km (0.4 mi) | No data | Fair weather | Dirt | 4.9 m (16 ft)/good | No shoulders | No shoulders | One lane |
| Fort Bliss #11 | 721232 | 775276 | 1 | 7.5 km (4.7 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #12** | 898528 | 909544 | 2-3 | 1.9 km (1.2 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #13 | 725284 | 758350 | 1 | 7.4 km (4.6 mi) | No data | Fair weather | Dirt | 4.9 m (16 ft)/poor | No shoulders | No shoulders | One lane, most of route not maintained |
| Fort Bliss #14 | 721267 | 730275 | 1 | 1.2 km (0.7 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #14** | 682525 | 673505 | 2 | 2.1 km (1.3 mi) | No data | Fair weather | Dirt | 3.7 m (12 ft)/poor | No shoulders | No shoulders | One lane, not maintained |
| Fort Bliss #15 | 742212 | 858243 | 1 | 11.8 km (7.3 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, also known as Butterfield Trail. |
| Fort Bliss #15** | 603509 | 585576 | 2 | 7.2 km (4.5 mi) | No data | Fair weather | Dirt | 4.9 m (16 ft)/good | No shoulders | No shoulders | One lane |
| Fort Bliss #16 | 750347 | 896349 | 1 | 15.4 km (9.6 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #18 | 772203 | 779208 | 1 | 1 km (0.6 mi) | No data | Fair weather | Caliche and dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #18** | 682529 | 682525 | 2 | 0.4 km (0.2 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #21** | 628604 | 664696 | 2 | 10.5 km (6.5 mi) | No data | Fair weather | Dirt | 3.7 to 6.1 m (12 to 20 ft)/fair | No shoulders | No shoulders | One or two lanes |
| Fort Bliss #22** | 602588 | 612578 | 2 | 1.4 km (0.9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #26** | 682723 | 651726 | 2 | 3.1 km (1.9 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #32** | 949769 | 913846 | 2-3 | 6 km (3.7 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, leaves installation boundary at 938786 and and reenters at 932812. |
| Fort Bliss #33** | 912843 | 841721 | 2-3 | 14.5 km (9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #37** | 418925 | 441862 | 4 | 15 km (9.3 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #38** | 450950 | 466011 | 4 | 14 km (8.7 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #39** | 975810 | 141702 | 2-3 | 22.3 km (13.9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor to good | No shoulders | No shoulders | Two lanes, not maintained from 985794 to 045800. |
| Fort Bliss #40** | 878638 | 047820 | 2-3 | 28.5 (17.7 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #41** | 126454 | 473930 | 1-3-4 | 56.5 km (35.1 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, leaves reservation boundary in many places. |
| Fort Bliss #42 | 686295 | 728294 | 1 | 3.8 km (2.4 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, also known as Launcher Road. |
| Fort Bliss #42** | 052072 | 287107 | 4 | 28 km (17.4 mi) | No data | Fair weather | Dirt | 3 to 6.1 m (10 to 20 ft) /poor to good | No shoulders | No shoulders | One or two lanes, passable only to four-wheel-drive vehicles in mountainous portions, also known as Grapevine Canyon Road. |

# J. LINES OF COMMUNICATION (Continued)

## 1. ROADS (Continued)

| ROUTE NUMBER/NAME | ROUTE LOCATION (GRID REFERENCE) FROM | TO | MAP SHEET | LENGTH OF SEGMENT* | MILITARY LOAD CLASSIFICATION | ROUTE TYPE | SURFACE CONSTRUCTION MATERIALS | SURFACE WIDTH/CONDITION* | SHOULDER CONSTRUCTION MATERIALS | SHOULDER WIDTH/CONDITION* | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fort Bliss #43 | 687285 | 687294 | 1 | 1.3 km (0.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #43** | 130969 | 339082 | 4 | 27.5 km (17.1 mi) | No data | Fair weather | Dirt | 3 to 6.1 m (10 to 20 ft) /poor to good | No shoulders | No shoulders | One or two lanes, passable in mountainous portions only to four-wheel-drive vehicles, also known as Culp Canyon Road. |
| Fort Bliss #44 | 694285 | 694294 | 1 | 1.3 km (0.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #44** | 397921 | 322023 | 4 | 14 km (8.7 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes, also known as El Paso Canyon Road. |
| Fort Bliss #45 | 702285 | 702294 | 1 | 1.3 km (0.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #45** | 103090 | 113089 | 4 | 1.3 km (0.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #48 | 800202 | 800411 | 1 | 21.7 km (13.5 mi) | No data | Fair weather | Caliche and dirt | 3 m (10 ft)/good | No shoulders | No shoulders | One lane |
| Fort Bliss #48** | 848467 | 843497 | 1 | 4.2 km (2.6 mi) | No data | Fair weather | Dirt | 4.9 to 6.1 m (16 to 20 ft) /poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #49 | 682274 | 695285 | 1 | 1.5 km (0.9 mi) | No data | Fair weather | Dirt | 3.7 to 4.9 m (12 to 16 ft) /poor | No shoulders | No shoulders | One lane, not maintained |
| Fort Bliss #49** | 930412 | 999374 | 1 | 11.8 km (7.3 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #50** | 924513 | 020442 | 1-3 | 16.5 km (10.3 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #53** | 995514 | 167493 | 1-3 | 22 km (13.7 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #55** | 019525 | 199568 | 3 | 44 km (27.3 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #56** | 076568 | 162565 | 3 | 28 km (17.4 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #57** | 990681 | 109608 | 3 | 16 km (9.9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #58** | 038694 | 157575 | 3 | 38.3 km (23.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #59** | 113606 | 140699 | 3 | 18.5 km (11.5 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #60** | 305934 | 186551 | 3-4 | 43.8 km (27.2 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #61** | 140699 | 257730 | 3 | 14.5 km (9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #62** | 047820 | 140699 | 3 | 33 km (20.5 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #63** | 174785 | 287850 | 3 | 14.5 km (9 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained from 174785 to 215818. |
| Fort Bliss #64** | 287845 | 360830 | 3 | 12.5 km (7.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #65** | 230948 | 417826 | 3-4 | 52.8 km (32.8 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #67** | 048820 | 043845 | 3 | 2.4 km (1.5 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #68** | 047823 | 069900 | 3-4 | 19.3 km (12 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes, road network runs from 047823-058833-110856-073882-069900 and from 073882 loops back to 058833. |
| Fort Bliss #69** | 069899 | 184057 | 4 | 21.5 km (13.4 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/fair | No shoulders | No shoulders | Two lanes, some sections not maintained. |
| Fort Bliss #72** | 651726 | 512747 | 2 | 14.8 km (9.2 mi) | No data | Fair weather | Dirt | 3.7 m (12 ft)/poor | No shoulders | No shoulders | One lane, not maintained from 538733 to 512747, also known as Soledad Canyon Road. |
| Fort Bliss #76** | 627603 | 633517 | 2 | 8 km (5 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #78** | 615598 | 621591 | 2 | 1 km (0.6 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #80** | 683696 | 662698 | 2 | 2.3 km (1.4 mi) | No data | Fair weather | Dirt | 3.7 m (12 ft)/poor | No shoulders | No shoulders | One lane, not maintained |
| Fort Bliss #82** | 681529 | 679537 | 2 | 0.8 km (0.5 mi) | No data | Fair weather | Dirt | 3.7 m (12 ft)/fair | No shoulders | No shoulders | One lane |
| Fort Bliss #85** | 987807 | 988806 | 2-3 | 0.4 km (0.2 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes |
| Fort Bliss #87** | 894440 | 924470 | 1 | 4.2 km (2.6 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/poor | No shoulders | No shoulders | Two lanes, not maintained |
| Fort Bliss #88** | 917440 | 917479 | 1 | 0.8 km (0.5 mi) | No data | Fair weather | Dirt | 6.1 to 7.3 m (20 to 24 ft) /fair | No shoulders | No shoulders | Two lanes |
| Fort Bliss #89** | 767514 | 779525 | 2 | 1.8 km (1.1 mi) | No data | Fair weather | Dirt | 3.7 m (12 ft)/poor | No shoulders | No shoulders | One lane, not maintained |
| Fort Bliss #92** | 714535 | 708586 | 2 | 5.1 km (2.3 mi) | No data | Fair weather | Dirt | 4.6 m (15 ft)/poor | No shoulders | No shoulders | One lane, not maintained |
| New Mexico 506 | 037995 | 488957 | 4 | 47.3 km (29.4 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes |
| Tank trails: | | | | | | | | | | | |
| Dona Ana Camp Loop | 585574 | 585574 (loop) | 2 | 2.3 km (1.4 mi) | No data | All weather | Bituminous | 6.7 m (22 ft)/poor | Gravel | 2.4 m (8 ft)/good | Two lanes, tanks authorized from 576579 to 585574 only. |
| Naples Road | 572576 | 561654 | 2 | 5.8 km (3.6 mi) | No data | Fair weather | Dirt | 6.1 to 9.1 m (20 to 30 ft) /good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #1 | 660215 | 799496 | 1 | 24.9 km (15.5 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, tanks authorized from 660215 to 681285 only. |
| Fort Bliss #2 | 670211 | 730275 | 1 | 10.5 km (6.5 mi) | No data | Fair weather | Caliche and dirt | 15.2 m (50 ft)/good | No shoulders | No shoulders | Four lanes, entire route is authorized for tanks. |
| Fort Bliss #17 | 730275 | 800411 | 1 | 15.5 km (9.6 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #19** | 543559 | 567587 | 2 | 8 km (5 mi) | No data | Fair weather | Dirt | 7.3 to 9.1 m (24 to 30 ft) /good | No shoulders | No shoulders | Two lanes, authorized for tanks from 543558 to 527590 only. |
| Fort Bliss #20** | 572576 | 509533 | 2 | 7.5 km (4.7 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, authorized for tanks from 572576 to 543559 only, also known as Berino Road. |
| Fort Bliss #23** | 625515 | 606590 | 2 | 8.7 km (5.4 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #27** | 651726 | 681659 | 2 | 9 km (5.6 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #28** | 651726 | 629781 | 2 | 6 km (3.7 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, tanks authorized from 651726 to 637761 only, road is in poor condition from 637761 to 629781. |
| Fort Bliss #41 | 680285 | 737283 | 1 | 5.5 km (3.4 mi) | No data | Fair weather | Caliche and dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks, also known as IFC Road. |
| Fort Bliss #46** | 835560 | 880497 | 1-2 | 9 km (5.6 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #70** | 917857 | 801724 | 2 | 15.8 km (9.8 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks, alinement of route is approximate. |
| Fort Bliss #71** | 682734 | 885717 | 2 | 19.1 km (11.9 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #73** | 774727 | 737530 | 2 | 25.1 km (15.6 mi) | No data | Fair weather | Dirt | 6.1 to 9.1 m (20 to 30 ft) /good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #74** | 681659 | 743664 | 2 | 6.1 km (3.8 mi) | No data | Fair weather | Dirt | 5.5 m (18 ft)/fair | No shoulders | No shoulders | One lane, entire route is authorized for tanks. |
| Fort Bliss #75 | 763589 | 832561 | 2 | 7.4 km (4.6 mi) | No data | Fair weather | Dirt | 6.1 m (20 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. Tracked vehicles not authorized to cross route US 54 and the Southern Pacific easement at 832560. This crossing restricted to wheeled vehicles only. |
| Fort Bliss #77 | 590577 | 659566 | 2 | 9 km (5.6 mi) | No data | Fair weather | Dirt | 6.1 to 9.1 m (20 to 30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #79 | 682736 | 688671 | 2 | 6.9 km (4.3 mi) | No data | Fair weather | Dirt | 4.9 to 6.1 m (16 to 20 ft) /good | No shoulders | No shoulders | One to two lanes, entire route is authorized for tanks. |
| Fort Bliss #81 | 800411 | 799496 | 1 | 6 km (3.7 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes, location approximate, entire route is authorized for tanks, a tank crossing point associated with this route and route 94 is at 798496 and crosses Southern Pacific Railroad main line single track and siding, standard gage, 1.44 m (4 ft 8.5 in), slag ballast, 4.9 m (16 ft) between lines, rail weight 55.9 kg/m (113 lb/yd); also crosses Southern Pacific petroleum products pipeline, diameter 15.2 cm (6 in), depth underground approximately 1.5 m (5 ft). These items in an easement, not government property. |
| Fort Bliss #83** | 576579 | 572576 | 2 | 0.5 km (0.3 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks, also known as Anzio Road. |
| Fort Bliss #84** | 791500 | 659566 | 1-2 | 7.6 km (4.7 mi) | No data | Fair weather | Dirt | 7.3 m (24 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #93** | 728535 | 600508 | 2 | 13 km (8.1 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |
| Fort Bliss #94** | 791500 | 727535 | 2 | 7.2 km (4.5 mi) | No data | Fair weather | Dirt | 9.1 m (30 ft)/good | No shoulders | No shoulders | Two lanes, entire route is authorized for tanks. |

| UNNUMBERED AND UNNAMED ROUTES | TOTAL LENGTH* | MILITARY LOAD CLASSIFICATION | ROUTE TYPE | SURFACE CONSTRUCTION MATERIALS | SURFACE WIDTH/CONDITION* | SHOULDER CONSTRUCTION MATERIALS | SHOULDER WIDTH/CONDITION* | REMARKS |
|---|---|---|---|---|---|---|---|---|
| Hard surfaced roads | 14.1 km (8.8 mi) | No data | All weather | Asphalt | 6.1 to 7.3 m (20 to 24 ft) /good | Dirt or gravel | 2.4 m (8 ft)/good | Two lanes |
| Improved dirt surfaced roads | 519.5 km (322.8 mi) | No data | Fair weather | Dirt or dirt and caliche | 3 to 9.1 m (10 to 30 ft) /poor to good | No shoulders | No shoulders | One or two lanes |
| Unimproved dirt surfaced roads | 818.2 km (508.4 mi) | No data | Fair weather | Dirt | 3 to 7.3 m (10 to 24 ft) /poor to good | No shoulders | No shoulders | One or two lanes |
| Tank trails | 61.5 km (38.2 mi) | No data | Fair weather | Dirt | 7.3 to 9.1 m (24 to 30 ft) /good | No shoulders | No shoulders | Two lanes |

*Generally, length of road segments were measured in kilometers and converted to miles, and surface and shoulder widths were measured in feet and converted to meters.
**Fort Bliss route located in New Mexico. Fort Bliss has two numbering sequences for range roads, one for Texas and one for New Mexico.

# J. LINES OF COMMUNICATION (Continued)

## 2. RAILROADS

The limited railroad trackage on Fort Bliss serves only the main cantonment area. Southern Pacific Transportation Company provides spurs from their Tucumcari to El Paso main line, which is located in a privately owned strip of land through the reservation and averages ten trains per day in each direction. Trackage in this strip has not been included in the study because it is not government-owned or on government land, except for two short portions in the main cantonment which are included to show government spur connections. US Army trackage totals 18 km (11.2 mi) and Southern Pacific totals 3.7 km (2.3 mi), excluding trackage located in easements.

US Army railroad equipment at Fort Bliss includes two 60-ton locomotives, nine boxcars, three flat cars, one mobile ramp, one 40-ton locomotive crane, and fifty 36,000 pound magnesium expanders for use in loading wheeled vehicles. An approved plan will move all rail operations to the ammunition storage area, but no implementation date has been set.

The installation has a current daily capability of handling two box cars, 50 flat cars, one refrigerator car, and eight cars of other types. Mobilization capacities, using 254 additional spanners and railyards in downtown El Paso, total four boxcars, 177 flat cars, two refrigerator cars, and 12 cars of other types. The reservation is served by one train per working day.

| IDENTIFICATION | SEGMENT OF TRACK (GRID REFERENCE) FROM | TO | MAP SHEET | LENGTH OF SEGMENT | OWNERSHIP OF LINE AND CONDITION OF TRACK | TRACK AND BED CHARACTERISTICS* | CROSSOVERS (GRID REFERENCE) | SPURS | VOLUME OF TRAFFIC | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| Track 1 | 648220 | 664246 | 1 | 3.7 km (2.3 mi) | All segments are owned by Fort Bliss except tracks 1, 16, and 17, which are owned by Southern Pacific Transportation Company. Segments 16 and 17 are located in easements and are included for completeness. Condition of all tracks is good. | Track 1, weight of rails 113.9 kg/m (90 lb/ft), slag ballast. | None | All track segments are spurs. | No data | Length of segment includes total trackage for dual lines. Track identification numbers assigned for this study are not official designations. A tank crossing point, not listed elsewhere, is located on Track 1 at 659228. |
| Track 2 | 641214 | 643217 | 1 | 1.1 km (0.7 mi) | | Track 2, double spur | | | | |
| Track 3 | 638208 | 639204 | 1 | 0.3 km (0.2 mi) | | | | | | |
| Track 4 | 644207 | 638208 and 638206 and 639205 | 1 | 1.6 km (1 mi) | | Track 4, weight of rails on curve 129.5 kg/m (87 lb/ft) | | | | |
| Track 5 | 645207 | 647207 | 1 | 0.3 km (0.2 mi) | | Track 5, double spur to locomotive shelter, building T-1378. | | | | |
| Track 6 | 648207 | 655208 | 1 | 1.7 km (1.1 mi) | | Track 6, double spur, weight of rails 133.9 kg/m (90 lb/ft). | | | | |
| Track 7 | 644206 | 655203 and 655207 | 1 | 2.3 km (1.4 mi) | | Track 7, double spur serves warehouses. | | | | |
| Track 8 | 645206 | 654204 | 1 | 1.2 km (0.8 mi) | | Track 8, double spur serves warehouses. | | | | |
| Track 9 | 648203 | 655203 | 1 | 1.2 km (0.8 mi) | | Track 9, double spur serves warehouses. | | | | |
| Track 10 | 655203 | 655219 | 1 | 1.6 km (1 mi) | | Track 10, weight of rails 111.6 kg/m (75 lb/ft). | | | | |
| Track 11 | 655214 | 659211 | 1 | 0.9 km (0.6 mi) | | Track 11, weight of rails 126.5 kg/m (85 lb/ft). | | | | |
| Track 12 | 655219 | 688226 | 1 | 3.7 km (2.3 mi) | | Track 12, double spur from 681226 to 683226. | | | | |
| Track 13 | 674220 | 677220 | 1 | 0.3 km (0.2 mi) | | Track 13, double spur. | | | | |
| Track 14 | 678223 | 682224 | 1 | 0.6 km (0.4 mi) | | Track 14, double spur. | | | | |
| Track 15 | 679224 | 681225 | 1 | 0.6 km (0.4 mi) | | Track 15, double spur. | | | | |
| Track 16 | 671187 | 655203 | 1 | 2.3 km (1.4 mi) | | Track 16, weight of rails 113.9 kg/m (90 lb/ft), slag ballast. | | | | |
| Track 17 | 641214 | 657244 | 1 | 2.3 km (1.4 mi) | | Track 17, weight of rails 168.1 kg/m (113 lb/ft), slag ballast. | | | | |

*Unless otherwise noted, single track; standard gage, (1.44 m or 4 ft 8.5 in); maximum grade less than one percent; minimum radius of curvature 204.2 m (670 ft); ballast material crushed stone; weight of rails 119 kg/m (80 lb/ft).

## 3. AIRFIELDS/AIRSTRIPS

The only airfield on Fort Bliss, Biggs Army Airfield, is northeast of the main cantonment area and provides transient service for military aircraft and mission-assigned aircraft. Navigational aid facilities are provided for instrument operations. The airfield has the operational capability to land all types of military aircraft, including the C-5A Galaxy; however, there are weight restrictions on various access and apron areas. Limited services are available for light fixed-wing and rotary-wing aircraft only.

There are no useable airstrips on the installation. Two abandoned airstrips, one at McGregor Range Camp, the other at Orogrande Range Camp, have not been used for many years and are not scheduled for reactivation. See L. Non-Urban Culture Features for descriptions.

| MAP NUMBER AND NAME; LOCATION; TYPE; AND CLASSIFICATION | MAP SHEET | ELEVATION AND STATUS | RUNWAY DESCRIPTION | TAXIWAY, PARKING APRON, AND HARDSTAND DESCRIPTION | BUILDING DESCRIPTION | POL FACILITIES | NAVIGATION AIDS | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1. Biggs Army Airfield; 696245; Airfield; Army | 1 | 1203 m (3947 ft) Operational | Primary runway: 4132 x 91 m (13,555 x 300 ft); azimuth 030° -210° magnetic; weight bearing capacity, S220, T330, ST175, TT440*; asphaltic concrete and portland cement concrete surface; good condition. Although C-5A aircraft routinely land at Biggs, no twin-delta tandem (TDT) ratings are listed in the DOD Flight Information Publications. | Taxiway TR-1: 1962 x 23 m (6438 x 75 ft); weight bearing capacity same as runway; portland cement concrete surface.<br>Taxiway TA-1A: Approximately 1905 x 18 m (6250 x 60 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TS-1: Approximately 87 x 15 m (285 x 50 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TA-2: Approximately 823 x 30 m (2700 x 100 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TA-2A: Approximately 134 x 23 m (440 x 75 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TA-2B: Approximately 113 x 30 m (370 x 100 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TS-2: Approximately 305 x 18 m (1000 x 60 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TR-3: 1257 x 23 m (4125 x 75 ft); weight bearing capacity same as runway; portland cement concrete, prestressed portland cement concrete, and reinforced portland cement concrete surface.<br>Taxiway TA-4: 1730 x 23 m (5675 x 75 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TR-4A: 1146 x 30 m (3759 x 100 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TR-4B: 550 x 23 m (1805 x 75 ft); weight bearing capacity same as runway; portland cement concrete surface.<br>Taxiway TR-4C: Approximately 226 x 183 m (740 x 600 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TA-5: Approximately 134 x 23 m (440 x 75 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TR-6: Approximately 1067 x 23 m (3500 x 75 ft); weight bearing capacity, no data; asphaltic concrete surface.<br>Taxiway TR-7: Irregular shape, approximately 14,413 m² (155,145 ft²); weight bearing capacity, no data; portland cement concrete and asphaltic concrete surface.<br>Taxiway T-7: Approximately 526 x 30 m (1725 x 100 ft); weight bearing capacity, no data; portland cement concrete surface.<br>Taxiway TA-10: Irregular shape, approximately 5285 m² (56,887 ft²); weight bearing capacity, no data; asphaltic concrete surface.<br>NE warm-up apron: Semi-circle with radius of 84 m (275 ft), area 3467 m² (373,196 ft²); weight bearing capacity same as runway; portland cement concrete surface. | Hangars: Building #11005, 3744 m² (40,300 ft²); building #11108, 16,118 m² (173,503 ft²); building #11202, 4766 m² (51,302 ft²); all are steel, permanent.<br>Administration and terminal buildings:<br>Control tower, building #11107, 37 m² (393 ft²), brick, permanent. Two control towers, buildings #11602 and #11628, inactive.<br>Operations and terminal facility, building #11210, 809 m² (8708 ft²), brick, permanent.<br>Fire station and administrative, building #11211, 357 m² (3840 ft²), brick, permanent.<br>Maintenance facilities:<br>Metal and woodwork shop, building #11111, 2256 m² (24,279 ft²), wooden, semi-permanent; and hangar buildings #11005, #11108, #11202 (described above).<br>Other buildings:<br>Aircraft armament, eight storage bunkers, buildings #11505, #11506, #11507, #11509, #11511, #11512, #11514, and #11562, total area 1630 m² (17,547 ft²), concrete and steel igloos, all semi-permanent. Ammo renovation shop, building # 11515, 671 m² (7219 ft²), brick, permanent. General purpose magazine, building #11516, 255 m² (2739 ft²), brick, permanent.<br>Miscellaneous, standby 15 kw generator, building #11012; jet test cell, building #11601; aircraft wash stand, building #11412; water tank, building #11101; water well pumps, buildings #11182 and #11241; incinerator, building #11284; gas heating plant, building #11375; electrical power sub-station, building #11521; and small arms range, pistol, building #11611. | Underground storage tanks: Four tanks, JP-4, total capacity 382,769 liters (101,128 gal). One tank, US aviation gasoline (MIL SPECS) 115-145, capacity 94,776 liters (25,040 gal). Fuel is pumped directly from delivery trucks into tanks. Fuel is pumped from the tanks into aircraft refueling trucks at buildings #11103 and #11104.<br>Refueling trucks: Two 4542 liter (1200 gal) tanker trucks, JP-4; one 9084 liter (2400 gal) tanker truck, JP-4; one 4542 liter (1200 gal) tanker truck, 100 octane low-lead. Tenant units at Fort Bliss have additional fuel tanker trucks.<br>Fuel and lubricants: US aviation fuels (MIL SPECS) 115-145 and JP-4; US aviation oils (MIL SPECS) 0-128 and 0-156; available only during flight operations business hours (0600-2200 hours local time, Mon-Fri, excluding holidays). Water and alcohol, alcohol, MOGAS diesel oil, kerosene, demineralized water and solvent also available for local use only. No fuel or service for aircraft over 5670 kg (12,500 lb). Service for heavy aircraft at El Paso International. | Control tower: 1203 m (3947 ft) above MSL, height 11 m (35 ft); aircraft control rating, heavy duty.<br>Communications: UHF and VHF radio, stage III radar service (El Paso), El Paso approach and departure control.<br>Radio Aids to Navigation: Newman BVORTAC EWM 112.4 Channel 17, 210°, 13.1 km (7.1 nautical miles) to field, TACAN unusable.<br>Radar: Radio contact frequencies 307.0 and 118.7, area surveillance radar, El Paso control.<br>Lights: Rotating beacon and and temporary lighting available. Taxiway lighting. High intensity runway lights available during tower hours. Prior permission required at other times. | Franklin Mountains, with elevations reaching 1903 m (6244 ft), are approximately 6000 m (19,686 ft) from the southwest end of the runway.<br>Field is open from 0600-2200 hours, Mon-Fri, excluding holidays.<br>Prior permission and flight plan required for civil aircraft. Prior permission required for transient aircraft training in local traffic pattern. |

# J. LINES OF COMMUNICATION (Continued)

## 3. AIRFIELDS/AIRSTRIPS (Continued)

| MAP NUMBER AND NAME; LOCATION; TYPE; AND CLASSIFICATION | MAP SHEET | ELEVATION AND STATUS | RUNWAY DESCRIPTION | TAXIWAY, PARKING APRON, AND HARDSTAND DESCRIPTION | BUILDING DESCRIPTION | POL FACILITIES | NAVIGATION AIDS | REMARKS |
|---|---|---|---|---|---|---|---|---|
| | | | | SW warm-up apron (TA-9): Approximately 68,221 m² (734,353 ft²); weight bearing capacity same as runway; portland cement concrete surface.<br><br>Operational apron (parking): 1000 x 152 m (3280 x 500 ft); weight bearing capacity, no data; asphaltic concrete surface, limited use due to surface condition.<br><br>Hangar apron TA-11: Irregular shape, approximately 40,356 m² (434,406 ft²); weight bearing capacity same as runway; portland cement concrete surface.<br><br>Hangar apron TA-12: Irregular shape, approximately 115,304 m² (1,241,160 ft²); weight bearing capacity, no data; portland cement concrete and asphaltic concrete surface.<br><br>Overruns (blast pads): NE overrun, 351 x 30 m (1150 x 100 ft); weight bearing capacity same as runway; asphaltic concrete surface. SE overrun, 290 x 30 m (950 x 100 ft); weight bearing capacity same as runway; asphaltic concrete surface.<br><br>Hardstands: Nine in Alert area, portland cement concrete surface; 17 in east hardstand area, asphaltic concrete surface; seven in west hardstand area, asphaltic concrete surface; seven in north warm-up area, asphaltic concrete surface. | | | | |

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT, TDT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.

S - Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F-100).
T - Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
ST - Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT - Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135).
TDT - Runway weight bearing capacity for aircraft with twin-delta tandem landing gear (C-5).

For further information, see DOD Flight Information Publication (Enroute IFR-Supplement United States).

## 4. PIPELINES

Fort Bliss is crossed by major natural gas and petroleum pipelines mostly oriented southeast-northwest. These lines provide natural gas to California and petroleum liquid products to Holloman Air Force Base and Alamogordo, New Mexico. Various natural gas, water, and sewer distribution lines serve White Sands Missile Range, and McGregor and Dona Ana Range Camps. The Orogrande waterline runs east-west and is in very poor condition. It supplies all water for the town of Orogrande, New Mexico, and adjacent ranches. There are no pumping stations on major lines on Fort Bliss, but large above-ground valves are located on the natural gas lines. The Bureau of Land Management operates an extensive water system on Otero Mesa solely for cattle raising. Lines as small as garden hoses are used to fill watering troughs in pastures leased to ranches.

| MAP NUMBER AND/OR NAME | GRID REFERENCE FROM | GRID REFERENCE TO | MAP SHEET | STATUS | OWNERSHIP | PIPELINE CHARACTERISTICS | TANK CROSSING SITES GRID REFERENCE | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1. Orogrande water line | 285106 | 035928 | 4 | Operative | City of Alamogordo, NM (leased to B.B. Johnson Ranch) | Diameter 10.2 to 25.4 cm (4 to 10 in), length in study area 31.9 km (19.8 mi), water line, depth underground approximately 0.6 m (2 ft). | None | Primary source is the Sacramento River with gravity flow from the Sacramento Mountains, non-chlorinated. Pipe material includes wood, metal, and plastic, with much of the line on the surface. Water in pipe at Orogrande seldom exceeds a two-inch flow in the six-inch line. Line failures occur on an average of once per month. A new system is planned in 1979. |
| 2. Otero Mesa water system | 331083 | 239658 | 3-4 | Operative | Department of the Interior, Bureau of Land Management | Diameter 3.8 to 15.2 cm (1.5 to 6 in), length in study area 135 km (83.9 mi), water line, depth underground approximately 0.6 m (2 ft). | None | Primary source is the Sacramento River with gravity flow from the Sacramento Mountains, non-chlorinated. Pipe material includes metal, rubber, and plastic, with some of the line on the surface. The numerous tank and trough feeder lines tend to be small and at or near ground level. |
| 3. Nations East Well water line | 865291 | 865285 | 1 | Operative | Hot Wells Ranch | Diameter 3.8 cm (1.5 in), length in study area 0.6 km (0.4 mi), water line, depth underground approximately 0.6 m (2 ft). pumping station location at 865291. | None | Source is Nations East Well, plastic pipe material. |
| 4. Tank car water line | 858246 | 820260 | 1 | Operative | Hot Wells Ranch | Diameter 3.6 cm (1.4 in), length in study area 5.6 km (3.5 mi), water line, depth underground approximately 0.6 m (2 ft). | None | Source is Nations East Well, plastic pipe material. |
| 5. Well 15 water collection line | 703267 | 706283 | 1 | Operative | Fort Bliss | Diameter 35.6 cm (14 in), length in study area 1.4 km (0.9 mi), water line, depth underground approximately 0.6 m (2 ft), pumping station location at 706283. | None | Non-chlorinated well line from well 15. |
| 6. Well 14 water collection line | 687267 | 686283 | 1 | Operative | Fort Bliss | Diameter 25.4 cm (10 in), length in study area 1.4 km (0.9 mi), water line, depth underground approximately 0.6 m (2 ft), pumping station location at 687283. | None | Non-chlorinated well line from well 14. |
| 7. Unnamed water line | 683267 | 698271 | 1 | Operative | Fort Bliss | Diameter 15.2 to 30.5 cm (6 to 12 in), length in study area 1.9 km (1.2 mi), water line, depth underground approximately 0.6 m (2 ft). | None | Serves Hawk Radar Park. |
| 8. Sewer line #T1 | 670267 | 698271 | 1 | Operative | Fort Bliss | Diameter 20.3 to 25.4 cm (8 to 10 in), length in study area 3 km (1.9 mi), sewer line, depth underground approximately 0.6 m (2 ft). | 670267 | Serves Hawk Radar Park. |
| 9. Unnamed sewer line | 889492 | 886486 | 1 | Operative | Fort Bliss | Diameter 25.4 cm (10 in), length in study area 0.6 km (0.4 mi), sewer line, depth underground approximately 0.6 m (2 ft). | None | Serves McGregor Range Camp. |
| 10. EPNG #2126 | 715347 | 889492 | 1 | Operative | El Paso Natural Gas Company | Diameter 5.1 to 7.3 cm (2 to 2.9 in), length in study area 22.8 km (14.2 mi), natural gas line, design capacity 6.8 mcm/d[1] (241 mcf/d)[2], average throughput 3.9 mcm/d (137 mcf/d), depth underground approximately 1.5 m (5 ft). | 800418 | Serves McGregor Range Camp. |
| 11. McGregor Range water line | 753414 | 885496 | 1 | Operative | City of El Paso | Diameter 30.5 cm (12 in), length in study area 17.7 km (11 mi), water line, depth underground approximately 0.6 m (2 ft). | 799496<br>880497 | Source is El Paso water system. |
| 12. Standard Oil of Texas | 736234 | 715347 | 1 | Operative | Standard Oil Company of Texas | Diameter 20.3 cm (8 in), length in study area 11.4 km (7.1 mi), petroleum line, depth underground approximately 1.5 m (5 ft). | 735281<br>735282 | Long-distance through line carrying a variety of products. |
| 13. SPTC Southwest Petroleum Transmission Line | 735234 | 715347 | 1 | Operative | Southern Pacific Transportation Company | Diameter 15.2 cm (6 in) length in study area 11.4 km (7.1 mi), petroleum line, depth underground approximately 1.5 m (5 ft). | 734281<br>734282 | Long-distance through line carrying a variety of products. |
| 14. EPNG #1700, #1103, and #1100 | 715347 | 858230 | 1 | Operative | El Paso Natural Gas Company | Three separate lines, diameters 50.8 to 76.2 cm (20 to 30 in), length in study area 18.3 km (11.4 mi), natural gas lines, depth underground approximately 1.5 m (5 ft), above-ground valve located at 781293. | 760310 | Line #1700, 50.8 cm (20 in), Elcor-El Paso; line #1103, 76.2 cm (30 in), First California Loop; line #1100, 66 cm (26 in), California Main Line; all long-distance through lines. |
| 15. EPNG #1600 Waha-Ehrenberg | 715347 | 955331 | 1 | Operative | El Paso Natural Gas Company | Diameter 76.2 cm (30 in), length in study area 21.2 km (13.2 mi), natural gas line, depth underground approximately 1.5 m (5 ft), above-ground valves located at 799344 and 804344. | 766345 | Long-distance through line. |
| 16. EPNG #2063 | 671267 | 715347 | 1 | Operative | El Paso Natural Gas Company | Diameter 30.5 cm (12 in), length in study area 9.2 km (5.7 mi), natural gas line, depth underground approximately 1.5 m (5 ft), above-ground valve located at 715347. | 681285 | Connector supply line for city of El Paso distribution. |
| 17. EPNG #2035 and #2068 | 652502 | 663777 | 1-2 | Operative | El Paso Natural Gas Company | Diameter 10.2 to 15.2 cm (4 to 6 in), length in study area 27.4 km (17 mi), natural gas line, design capacity 327.4 mcm/d (11,561 mcf/d), average throughput 178.2 mcm/d (6294 mcf/d), above-ground valves located at 654522 and 660625. | 654522<br>659566<br>660623<br>661682<br>663737 | Line #2035 is 10.2 cm (4 in) in diameter and extends entire distance; line #2068 is a 25.4 cm (10 in) diameter loop which starts at 660625 and runs north, serves White Sands-Alamogordo area. |
| 18. Unnamed sewer line | 580577 | 577570 | 2 | Operative | Fort Bliss | Diameter 25.4 cm (10 in), length in study area 0.6 km (0.4 mi), sewer line, depth underground approximately 0.6 m (2 ft). | None | Serves Dona Ana Range Camp. |

Footnotes:
[1] Thousand cubic meters per day
[2] Thousand cubic feet per day

# J. LINES OF COMMUNICATION (Continued)

## 5. HELICOPTER LANDING ZONES

Three helicopter landing zones are designated in the main cantonment area, and sixteen other helicopter landing zones are located elsewhere on the reservation. Most of the installation is suitable for helicopter operations; there are numerous undesignated landing areas. Helicopter operations are routinely conducted at several areas of Biggs Army Airfield as part of normal airfield operations.

| MAP NUMBER AND/OR NAME | LOCATION (GRID REFERENCE) | MAP SHEET | DIMENSIONS | AZIMUTH | ELEVATION | SURFACE MATERIAL | RESTRAINTS | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1 McGregor VIP | 887493 | 1 | 69 m (225 ft) by 24 m (80 ft) | 090°-270° | 1250 m (4100 ft) | Asphalt | Utility poles in all directions from the pad to within 30 m (100 ft); buildings to north; caution must be exercised at low level. Rocks and debris on ramp and wide ditch 46 m (150 ft) to south; surface strength unlimited. | Almost flat terrain with slope of less than two percent to southwest. Wind sock 23 m (75 ft) from west side. |
| 2 Myer Range | 921435 | 1 | 18 m (60 ft) by 18 m (60 ft) | 000°-180° | 1250 m (4100 ft) | Dirt | Water tower, buildings, and utility poles to the north, east, and south; exercise extreme caution; vehicles cross pad on paved driveway enroute to water tower; dust and small rocks present; surface strength unlimited. | Non-operational; flat terrain. If used, recommended approach is north-south or east-west; no appreciable slope. |
| 3 Range 26 East (Cane Cholla Range East) | 876546 | 2 | 113 m (370 ft) by 56 m (185 ft) | 160°-340° | 1250 m (4100 ft) | Asphalt | Range poles to north, west, and northeast; power line marked with orange balls terminates at the southeast corner; portable bleachers sometimes present; small amounts of dust present; pad closed due to pieces of metal which become airborne when helicopter lands. | Non-operational pad on the flat surface of the eastern side of an in-flight control site in flat terrain. The west side of the same site is operational as helicopter landing zone number 4. |
| 4 Range 26 West (Cane Cholla Range West) | 876546 | 2 | 113 m (370 ft) by 56 m (185 ft) | 160°-340° | 1250 m (4100 ft) | Asphalt | Range poles to north, west, and northeast; power line marked with orange balls terminates at the southeast corner; portable bleachers sometimes present; small amounts of dust present. | "H" marker is on the southwest corner of the flat surface of an in-flight control site. The east side of the same site is helicopter landing zone number 3, which is closed; no appreciable slope. |
| 5 Redeye Firing Range | 057833 | 3 | 46 m (150 ft) by 46 m (150 ft) | 090°-270° | 1250 m (4100 ft) | Asphalt | Two antennas 500 m (1640 ft) north; utility wires, height 11 m (35 ft), to north, east, and south marked with orange balls; utility wires, height 11 m (35 ft), to the west on the edge of the pad not marked; small bushes growing on surface. | No appreciable slope. |
| 6 Orogrande Range Camp | 919852 | 2-3 | 30 m (100 ft) by 30 m (100 ft) | 040°-220° | 1311 m (4300 ft) | Oil sprayed dirt | Hill, 1356 m (4450 ft) high, approximately 200 m (656 ft) to the northwest; Elephant Mountain, 1425 m (4675 ft) high, 1000 m (3281 ft) to the southeast; dust rises around periphery on landing and takeoff; electrical power wires, height unknown, to north, northeast, and west; possibility of livestock on pad; dust present; surface breaking up with loose bricks and rocks. | Non-operational; steep slope to southeast. |
| 7 Range 54 | 634772 | 2 | 24 m (80 ft) by 24 m (80 ft) | 150°-330° | 1250 m (4100 ft) | Asphalt | Power lines approximately 100 m (328 ft) to west. | Slope of less than one percent to northeast. |
| 8 Range 52/53 | 643751 | 2 | 24 m (80 ft) by 24 m (80 ft) | 000°-180° | 1250 m (4100 ft) | Oil sprayed dirt | Power lines 225 m (738 ft) to southwest; blowing dust on approach; surface strength is unlimited. | Marked with Maltese cross; slope of less than one percent to northeast. |
| 9 Range 48/49 | 660693 | 2 | 24 m (80 ft) by 24 m (80 ft) | 135°-315° | 1250 m (4100 ft) | Asphalt | One utility pole 137 m (450 ft) south; telephone line running northeast-southwest approximately 50 m (164 ft) to the west. | Marked with Maltese cross; slope of less than one percent to the east. |
| 10 Range 46 | 601593 | 2 | 30 m (100 ft) by 30 m (100 ft) | 045°-225° | 1250 m (4100 ft) | Dirt | Four poles in a group west of helicopter landing zone; utility line along road 475 m (1558 ft) to southeast; blowing dust on approach; surface strength unlimited. | Helicopter landing zone is an unmarked clear area which extends beyond the defined limits of the pad in all directions; slope of less than one percent to southeast. |
| 11 Range 43 | 582581 | 2 | 38 m (125 ft) by 38 m (125 ft) | 090°-270° | 1244 m (4080 ft) | Asphalt | Power line along north edge of road 100 m (328 ft) to south, marked by orange marker balls; Dona Ana Range Camp across road. | Maltese cross painted on pad; wind sock to the southeast; slope of less than one percent to southeast. |
| 12 Range 40 | 539651 | 2 | 23 m (75 ft) by 23 m (75 ft) | 090°-270° | 1463 m (4800 ft) | Oil sprayed dirt | Utility poles approximately 200 m (656 ft) to north, marked with orange marker balls; ridgeline 500 m (1641 ft) east northeast of pad runs north to hill, 1785 m (5857 ft), located 1500 m (4922 ft) to northeast; surface strength unlimited. | Use caution on low-level approach. Slope approximately two percent to the south. |
| 13 Hueco Range Camp | 720536 | 2 | 75 m (246 ft) diameter circle | 090°-270° | 1225 m (4020 ft) | Dirt | Power line approximately 100 m (328 ft) to south between pad and road; water tower 500 m (1805 ft) to the west southwest; surface strength unlimited. | In flat terrain in old RCAT launching circle; pad is in the center of the asphalt RCAT circle; no appreciable slope. |
| 14 Missile Site 10 | 939501 | 1 | 20 m (66 ft) by 75 m (246 ft) | 000°-180° | 1262 m (4140 ft) | Asphalt | Building on launch pad just to east. | Slope of less than two percent to the southwest. |
| 15 Range 47 | 609595 | 2 | 400 m (1312 ft) by 20 m (66 ft) | 090°-270° | 1250 m (4100 ft) | Asphalt | Utility line 180 m (591 ft) to southwest across highway. | In flat terrain on old range access road; no appreciable slope. |
| 16 Davis Dome | 913493 | 1 | 91 m (300 ft) by 46 m (150 ft) | 090°-270° | 1256 m (4120 ft) | Dirt | Single utility pole 500 m (1641 ft) to northwest; utility wires 200 m (656 ft) south; hill with building and multiple antennas 300 m (984 ft) south; blowing dust on approach; surface strength unlimited. | Helicopter landing zone is at the northeastern end of abandoned landing strip; no appreciable slope. |
| 17 Beaumont Hospital | 617212 | 1 | 52 m (170 ft) by 52 m (170 ft) | 030°-210° | 2371 m (7780 ft) | Asphalt | Multi-story hospital building 152 m (500 ft) north of pad. | Marked with Maltese cross; approach bearing is 210° and departure is 030°; no appreciable slope. |
| 18 Post Command | 640199 | 1 | 73 m (240 ft) by 73 m (240 ft) | 000°-180° | 1189 m (3900 ft) | Turf | Buildings, trees, and power lines to east and west 91 m (300 ft) from center of open area; surface strength unlimited. | North of Fort Bliss headquarters on a parade field; no appreciable slope. |
| 19 Cavalry Command | 668205 | 1 | 300 m (984 ft) by 300 m (984 ft) | 000°-180° | 1189 m (3900 ft) | Crushed rock | Located between air approaches to El Paso International Airport and Biggs AAF; buildings and utility lines on all sides but none within 250 m (820 ft) of pad center; surface strength unlimited. | Maltese cross painted on crushed rock; no appreciable slope. |

## 6. DROP ZONES

There are five designated drop zones at Fort Bliss, only two of which have been used in recent years. Because of thorny mesquite, ocotillo, and cactus, clearing of the zones is required prior to use. Existing agreements restrict maneuvers at Hay Meadows, Beret, and Cabal drop zones. Caution should be exercised in the air approach to the drop zones because of the proximity of the Otero Mesa escarpment, Franklin Mountains, and Organ Mountains. Wind conditions, especially in the spring, often preclude parachute operations.

| MAP NUMBER AND/OR NAME | LOCATION (GRID REFERENCE) | MAP SHEET | DIMENSIONS | AZIMUTH | ELEVATION | SURFACE DESCRIPTION | AIRCRAFT OBSTRUCTIONS | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1 Hay Meadows | 128705<br>156741<br>197713<br>170677 | 3 | 4500 m (14,765 ft) by 5000 m (16,405 ft) | 315°-135° | 1494 m (4900 ft) | Overgrown with mesquite and cacti; on an outwash plain; slope less than two percent. | Otero Mesa escarpment, 152 m (500 ft) high, immediately to the east. | Recommended approach bearing is 315° over Otero Mesa, which has an elevation along the approach of 1671 m (5483 ft). Access roads are unimproved dirt. This drop zone has not been used in recent years and is inactive. |
| 2 Beret | 240940<br>290940<br>290900<br>240900 | 4 | 4000 m (13,124 ft) by 5000 m (16,405 ft) | 000°-180° | 1494 m (4900 ft) | Grassy pasture on Otero Mesa; slope two percent to the west. | Otero Mesa escarpment, 76 m (250 ft) high, approximately 1.8 to 3.5 km (1.1 to 2.2 mi) to the west. Obstruction elevations reach 1917 m (6289 ft); 5.1 km (3.2 mi) to the north. | Telephone line and barbed wire fence cut across extreme northeastern corner of drop zone. Recommended approach bearings are 180° or 135°. Excellent access is provided by New Mexico Route 506. This drop zone has not been used in recent years and is inactive. |
| 3 Cabal | 140960<br>170960<br>170930<br>140930 | 4 | 3000 m (9843 ft) by 3000 m (9843 ft) | 000°-180° and 090°-270° | 1311 m (4300 ft) | Overgrown with mesquite and cacti; on an alluvial apron; slope two percent to the west. | None | A telephone lines runs approximately 500 m (1640 ft) north of the drop zone along New Mexico Route 506, which provides excellent access. Recommended approach bearing is 340°. This drop zone has not been used in recent years and is inactive. |
| 4 Stewart | 555560<br>585560<br>585520<br>555520 | 2 | 3000 m (9843 ft) by 4000 m (13,124 ft) | 000°-180° | 1280 m (4200 ft) | Mostly grass with scattered small bushes on a nearly flat ephemeral lake bed. | Franklin Mountains, with elevations reaching 1903 m (6244 ft), approximately 5 km (3.1 mi) to the southwest. Organ Mountains, with elevations reaching 2704 m (8870 ft), approximately 10.5 km (6.5 mi) to the north. Bishop Cap, elevation 1652 m (5419 ft), approximately 12 km (7.5 mi) to the northwest. | A telephone line runs within 500 m (1640 ft) of the northwest corner. Access is by unimproved dirt roads in good condition leading from a medium-duty hard surfaced highway. Recommended approach bearings are 000°-090°-180°-270°. |
| 5 Old Coe Lake | 701678<br>708678<br>708661<br>701661 | 2 | 700 m (2297 ft) by 1700 m (5578 ft) | 000°-180° | 1195 m (3920 ft) | Mostly grass with scattered small bushes on a nearly flat ephemeral lake bed. | Organ Mountains, with elevations reaching 2704 m (8870 ft), approximately 14 km (8.7 mi) to the west. | A telephone line runs within 1600 m (5250 ft) of the western side. Access is by tank trail which runs through the southern end of drop zone. Recommended approach bearings are 000° and 180°. |

JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 3

JOINS MAP 1

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TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
ORO GRANDE
PENDEJO WASH
PRATHER RANCH
(Pictomap - Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782
Inset

# MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## LINES OF COMMUNICATION

### ROADS
- Hard surfaced road, 4 or more lanes
- Hard surfaced road, 2 lanes
- Tank Trail
- Improved dirt road
- Unimproved dirt road
- 54 — Federal route number
- S506 — State route number (Does not appear on this map)
- 18 — Military Reservation Route Marker
- Tank Crossing

### RAILROADS
- 1 — Railroad and identification number
- Single track, standard gauge
- Multiple track, standard gauge

### AIRFIELDS
- 1 — Orientation of runway is indicated by the placement of airfield

### PIPELINES
- 8 — Pipeline and identification number
- Pipehead
- P — Pumping Station

### HELICOPTER LANDING ZONES
- H 17

### DROP ZONES
- 1 — Does not appear on this map

Number on map refers to entry in table.

Scale 1:50,000
1 0 1 2 3 Statute Miles
1000 500 0 1000 2000 3000 Meters

CONTOUR INTERVAL
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40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, September 1978.

JOINS MAP 4

WHITE SANDS MISSILE RANGE

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST STAGE IMPACT AREA
(TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

ORGAN MOUNTAINS

DONA ANA IMPACT AREA

DONA ANA COUNTY / OTERO COUNTY

OLD COE LAKE

PERSHING FIRING FAN
(TEMPORARY CLOSINGS ONLY)

JOINS MAP 3

JOINS MAP 2

JOINS MAP 1

Scale 1:50,000

CONTOUR INTERVAL 40 FEET
WITH SUPPLEMENTARY
CONTOURS AT 20 FEET

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Series V781
Series V782

# MAP 2
# FORT BLISS, TEXAS TERRAIN ANALYSIS
## LINES OF COMMUNICATION

### ROADS

- Hard surfaced road, 4 or more lanes
- Hard surfaced road, 2 lanes
- Tank Trail
- Improved dirt road
- Unimproved dirt road
- 54 — Federal route number (Does not appear on this map)
- 5506 — State route number (Does not appear on this map)
- 10 — Military Reservation Route Marker
- Tank Crossing

### RAILROADS

- 1 — Railroad and identification number (Does not appear on this map)
- Single track, standard gauge (Does not appear on this map)
- Multiple track, standard gauge (Does not appear on this map)

### AIRFIELDS

- 1 — Orientation of runway is indicated by the placement of airfield (Does not appear on this map)

### PIPELINES

- 18 — Pipeline and identification number
- Pipehead
- P — Pumping Station (Does not appear on this map)

### HELICOPTER LANDING ZONES

- H 8

### DROP ZONES

- 1

Number on map refers to entry in table.

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JOINS MAP 4

JOINS MAP 2

JOINS MAP 1

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

PERSHING FIRST STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

TULAROSA VALLEY

OTERO MESA

HUECO MOUNTAINS

Orogrande

Three Buttes

Scale 1:50,000

CONTOUR INTERVAL

Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheets 4848 III, 4848 IV
50 FEET

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Series V781
Series V782

# MAP 3
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS

## LINES OF COMMUNICATION

### ROADS

- Does not appear on this map — Hard surfaced road, 4 or more lanes
- Hard surfaced road, 2 lanes
- Tank Trail
- Improved dirt road
- Unimproved dirt road
- Does not appear on this map — 54 — Federal route number
- Does not appear on this map — 5506 — State route number
- 10 — Military Reservation Route Marker
- Tank Crossing

### RAILROADS

- Does not appear on this map — Railroad and identification number
- Does not appear on this map — Single track, standard gauge
- Does not appear on this map — Multiple track, standard gauge

### AIRFIELDS

- Does not appear on this map — Orientation of runway is indicated by the placement of airfield

### PIPELINES

- Pipeline and identification number
- Does not appear on this map — Pipehead
- Does not appear on this map — P — Pumping Station

### HELICOPTER LANDING ZONES

H 5

### DROP ZONES

1

Number on map refers to entry in table.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## LINES OF COMMUNICATION

### ROADS

Does not appear on this map — Hard surfaced road, 4 or more lanes

Does not appear on this map — Hard surfaced road, 2 lanes

Does not appear on this map — Tank Trail

Improved dirt road

Unimproved dirt road

Does not appear on this map — 54 Federal route number

S506 State route number

10 Military Reservation Route Marker

Does not appear on this map — Tank Crossing

### RAILROADS

1 Railroad and identification number

Does not appear on this map — Single track, standard gauge

Does not appear on this map — Multiple track, standard gauge

### AIRFIELDS

Does not appear on this map — Orientation of runway is indicated by the placement of airfield

### PIPELINES

2 Pipeline and identification number

Does not appear on this map — Pipehead

Does not appear on this map — P Pumping Station

### HELICOPTER LANDING ZONES

Does not appear on this map — H 8

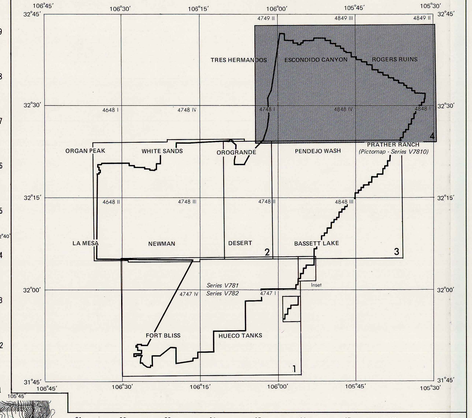
### DROP ZONES

1

Number on map refers to entry in table.

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40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET

Sheet 4749 II
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET

Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET

Sheet 4849 II
40 FEET

Sheets 4848 IV, 4849 III
50 FEET

JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# K. URBAN AREAS (CANTONMENT AREAS)

Most of the urban (cantonment) facilities at Fort Bliss are in the extreme southern part of the installation adjacent to the city of El Paso, TX. Logan Heights, Biggs Army Airfield (AAF), William Beaumont Army Medical Center (AMC), and the Main Post are all in this general area. The remaining urban features are in camps in the maneuver areas and on ranges in New Mexico north of the main cantonment areas. The principal range camps are Dona Ana, McGregor, and Orogrande. Dona Ana Range Camp is approximately 39 kilometers (24 miles) north of the Main Post; McGregor Range Camp is 39 kilometers (24 miles) northeast; and Orogrande Range Camp is 72 kilometers (45 miles) northeast.

The first two of the accompanying three maps present features on the Main Post, Logan Heights, Biggs AAF, and William Beaumont AMC; the third map shows features at the range camps.

Data in the tables and maps are for facilities existing as of February 1977. Most of the information on future plans was taken from documents produced in 1972 and 1973. An updated master plan is in preparation.

## RECREATION FACILITIES

Many of the indoor recreational facilities are housed in temporary buildings and are considered inadequate to meet current recreation demand. Future plans include modernization of some present facilities and construction of two bowling centers, four theaters, three service clubs, three craft shops, two libraries, two gymnasiums, and a large field house near cantonment areas in and near the Main Post. A theater and service club are proposed for Dona Ana Range Camp and a library for Orogrande Range Camp.

Most outdoor recreation facilities are in the Main Post, Logan Heights, Biggs AAF, and William Beaumont AMC cantonments, adjacent to housing areas. The majority of the facilities were constructed during the 1950's and 1960's and are in good condition.

Plans for expansion include a stadium around the running track in the southern part of the Main Post, an additional 18-hole golf course at Logan Heights, six new pools, approximately eight tennis and multi-purpose courts, and four softball fields. Additional playgrounds and volleyball courts are proposed for family housing and enlisted men billets areas, respectively.

| TYPE | CAPACITY | REMARKS |
|---|---|---|
| OUTDOOR FACILITIES | | |
| Tennis Courts (28) | | 2 lighted at Main Post |
| Multi-Purpose Courts (7) | | None lighted |
| Basketball Courts (3) | | One at Main Post, 2 at Orogrande Range Camp; none lighted |
| Volleyball Courts (17) | | None lighted |
| Softball Fields (17) | | 5 lighted |
| Baseball Fields (7) | | 2 lighted |
| Little League Fields (4) | | 3 lighted |
| Football Field (1) | | At Main Post, not lighted |
| Model Airplane Flying Area (1) | | At Main Post |
| Running Tracks (2) | 402 m (1320 ft) each | One oval, 1 circular, both asphalt surfaced, both at Main Post |
| Swimming Pools (9) | | None lighted or heated |
| Golf Course (1) | | 18-hole regulation course with clubhouse, near and north of Main Post |
| Golf Driving Range (1) | 75 persons | Not lighted, at golf course |
| Chipping Green (1) | 20 persons | Not lighted, at golf course |
| General Purpose Playgrounds (28) | | Near all cantonment areas |
| Bandstand/Pavillion Facilities (3) | | At Main Post and Biggs AAF |
| Rod and Gun Club (1) | | At Biggs AAF; clubhouse and following ranges are available:<br>Pistol, 23 to 46 m (75 to 150 ft), 20-point<br>Pistol, 25 to 100 m (82 to 328 ft), 5-point<br>Pistol, 50 to 200 m (164 to 656 ft), 5-point<br>Skeet, 2 machines, 8-point<br>Trap, 1 machine, 5-point<br>Black powder, 50 to 200 m (164 to 656 ft), 3-point<br>Plinking, 46 m (150 ft), no established points<br>.22 caliber, 40 to 100 m (131 to 328 ft), 5-point<br>Large bore rifle, 200 to 500 m (656 to 1641 ft), 2-point<br>Large bore rifle, 600 to 900 m (1969 to 2953 ft), 2-point<br>Large bore rifle, 200 to 1000 m (656 to 3281 ft), 5-point<br>Large bore rifle sighting, 46 m (150 ft), 10-point |
| INDOOR FACILITIES | | |
| Bowling Centers (5) | 62 lanes | Two centers at Main Post with 32 and 12 lanes; 1 each at Biggs AAF, Logan Heights, and Beaumont AMC with 6 lanes each. |
| Theaters (5) | 3956 seats | Two at Main Post seat 812 and 996; 1 each at Biggs AAF, Logan Heights, and McGregor Range Camp seat 900, 996, and 252, respectively. |
| Craft Shops/Skill Development Centers (6) | | Two general purpose, 1 at Biggs AAF and one on Main Post; 3 automotive shops at Main Post, Biggs AAF, and McGregor Range Camp; 1 woodwork shop at Main Post. |
| Gymnasiums (5) | 2200 seats | Two at Main Post which seat 800 to 1200; 1 at Biggs AAF which seats 200; 1 at McGregor Range Camp which has no seating. |
| Indoor Pistol Ranges (2) | | 16-point range at Main Post and 5-point range at Biggs AAF, at Rod and Gun Club. |
| Enlisted Member Service Clubs (5) | | Serves all cantonment areas. |
| Officers Clubs (2) | | At Main Post and McGregor Range Camp. |
| Officers Wives Club and Ceramic Center | | In 2 buildings at Main Post. |
| Youth Teen Centers (2) | | At Main Post and Biggs AAF. |
| Community Center Recreation Buildings (3) | | At Main Post, Logan Heights, and McGregor Range Camp. |
| Boy Scout Buildings (2) | | At Main Post |
| Girl Scout Buildings (2) | | At Main Post |
| Saddle Riding Club (1) | | At Biggs AAF |
| Workshop Theater (1) | 95 seats | At Main Post, seating not currently authorized for use due to lack of sprinkler system. |
| Music Center (1) | | At Main Post |
| Dinner Theater (1) | 150 seats | At Main Post |
| Libraries (9) | | Main library contains 70,000 volumes; others located at or serve the El Paso Community College at Logan Heights, William Beaumont AMC, Air Defense School, Sergeant Majors' Academy, Biggs AAF, McGregor Range Camp, Logan Heights; military occupational specialty library is at Main Post; branch library is operated at White Sands Missile Range. |
| Fort Bliss Replica and Museum | | Built by the City of El Paso in 1948, then donated to and maintained by Fort Bliss; contains general installation, area, and Army collections; located at Main Post. |
| 3d Armored Cavalry Regiment Museum | | Unit museum specifically for the 3d Armored Cavalry Regiment; located at Main Post. |

## SCHOOLS AND MEDICAL FACILITIES

| TYPE | CAPACITY | CURRENT LOAD | REMARKS |
|---|---|---|---|
| Schools | | | |
| Milam Elementary | 625 | 380 | These three elementary schools are presently leased to the El Paso Independent School District and are part of that system as described in the Off-Post Features topic. These schools now serve a significant off-post population as well as Fort Bliss housing areas. Under a desegregation order, both Bliss and Logan Elementary Schools will also begin serving off-post students in September 1978. Two additional facilities, Hughey Elementary School and Ross Intermediate School, were also on post, but were deeded to the school district in 1977.<br><br>According to the El Paso Independent School District, future enrollments will remain at relatively the same levels as at present. There are no plans for expanding any of the facilities. |
| Logan Elementary | 600 | 576 | |
| Bliss Elementary | 900 | 894 | |
| TOTAL | 2125 | 1850 | |
| Medical Facilities | | | |
| William Beaumont General Hospital | 608 beds | 394 beds | The William Beaumont General Hospital was constructed in 1972 and is in excellent condition. Current staff and funding is for 463 beds, of which 85 percent are normally in use. A helipad is immediately south of the hospital building.<br><br>The old general hospital is east of the new facility. This complex consists of nine temporary structures, of which six were constructed during World War II. The original capacity of this facility was 500 beds when it opened in 1921; capacity was expanded to a maximum of 1800 beds during World War II. Serving also through the Korean and Vietnam conflicts, the facilities far surpassed their original life expectancies. All of these buildings are to be demolished by 1983. |
| Dispensaries (2) | No beds | No beds | Dispensary facilities consist of the Troop Consolidated Health Facility and Dispensary No. 6. At present, Dispensary No. 6 serves as an officers' medical facility and will eventually be closed. All services will be incorporated into the Consolidated Health Facility, which will provide a medical clinic, physical examination areas, a pharmacy, a physical therapy, a laboratory, a radiology, a mental hygiene, and a health and environment clinic. |
| Dental Clinics (4) | 79 chairs (dental treatment rooms) | 77 chairs | Dental facilities consist of Clinic No. 1 (44 chairs), the Hospital Clinic (18 chairs), Clinic No. 3 (10 chairs), and Clinic No. 2 (7 chairs). An additional facility (Clinic No. 5 with 10 chairs) was taken out of service in March 1978. A fifth clinic (10 chairs) is maintained at White Sands Missile Range. A 28 chair clinic is programmed for construction during FY 1979. When the new clinic is completed, Clinic No. 3 will be retired and total capacity will be 97 chairs in four (4) units. |

## QUARTERS

| TYPE | NUMBER OF BUILDINGS | TOTAL CAPACITY | CURRENT LOAD | CONDITION* | REMARKS |
|---|---|---|---|---|---|
| BOQ | | | | | |
| Permanent | 23 | 712 | | Good to Excellent | Permanent quarters consist of 21 buildings in the Main Post-Logan Heights area and two buildings at Biggs AAF. All buildings were constructed between 1934 and 1962. |
| Semi-permanent | 6 | 32 | | Excellent | There are four semi-permanent buildings at McGregor Range and two buildings at Orogrande Range. These buildings were constructed between 1959 and 1961. |
| Temporary | 32 | 592 | | Poor to Excellent | Temporary BOQ facilities consist of mobilization-type structures with 26 buildings in the Main Post area, two buildings at the William Beaumont AMC, and four buildings in the Dona Ana Range Camp. The facilities at William Beaumont AMC were scheduled for replacement in 1976 and all temporary BOQ facilities at the Main Post are scheduled for replacement by 1981. All of these facilities are in poor condition. The four buildings at Dona Ana Range camp were built in 1966 and are in excellent condition.<br><br>The method for determining capacity and maximum utilization for bachelor housing facilities was being revised by Training and Doctrine Command (TRADOC) during the time this study was undertaken. Data on bachelor housing capacities are based on standards that applied as of January 1978. |
| Guest Quarters | | | | | |
| Permanent | 1 | 5 | 5 | Good | On-post guest quarters are in one building at the Main Post which is classified as a VIP guest house. |
| Semi-permanent | 2 | 39 | 29 | Good | At William Beaumont AMC. |
| Temporary | 1 | closed | 0 | Poor | In Logan Heights; reoccupation is not planned. |
| TOTAL | 65 | 1380 | 1208 | | Data for current load are presented for total installation because housing capacity and utilization records are not maintained according to building construction categories.<br><br>Utilization data for BOQ spaces available for February 1978 indicate a total of 596 spaces diverted to other uses. Specific uses to which these spaces were diverted include: 230 spaces at the Main Post and 117 spaces at Biggs AAF for senior enlisted bachelor quarters (SEBQ); 55 spaces at William Beaumont AMC and 128 spaces at the range camps for bachelor enlisted quarters; and 66 spaces at the Main Post for guest housing. |

*Building condition is determined from Estimated Economic Life (EEL) Code: Present to 1989 is poor; 1990 to 1999 is good; 2000 and beyond is excellent.

## NATURAL GAS

| CAPACITY | CURRENT LOAD | REMARKS |
|---|---|---|
| Undetermined | 47,598 Mcm* (1,680,713 Mcf*) (FY 1977) | Natural gas is supplied to Western Texas by El Paso Natural Gas Company and distributed to Fort Bliss by the Southern Union Gas Company. Delivery to the main cantonment areas is through six high pressure mains leading to six separate points. The distribution system is adequate for present requirements and can be extended rapidly should new construction occur.<br><br>Natural gas is used primarily for heating, cooking, and other residential and institutional applications. All boiler plants also use gas, but recently constructed and proposed plants have dual-use capabilities so that either oil or gas can be used. All older plants are being converted to dual usage capabilities.<br><br>Natural gas from sources within Texas and supplied by the El Paso Natural Gas Company is adequate for present and projected demands. |

*Mcm = thousand cubic meters
Mcf = thousand cubic feet

## ELECTRICITY

| SUBSTATIONS | TRANSFORMERS | CAPACITY | LOAD |
|---|---|---|---|
| Substation A | 3-333 KVA** | 1000 KVA | |
| Substation B | 3-500 KVA | 1500 KVA | |
| Van Horne Park Substation | 3-500 KVA | 1000 KVA | |
| Aero Vista Substation* | 1-750 KVA | 750 KVA | |
| Dona Ana Range Substation* | 1-300 KVA | 300 KVA | |
| McGregor Range Substation* | 1-7500 KVA | 7500 KVA | |
| TOTALS: | 12,550 KVA*** | 12,050 KVA*** | 137,134,496 KWH** (FY 1977) |

REMARKS

Electricity is provided to Fort Bliss by the El Paso Electric Company (EPEC). Two 115 KV** transmission lines supply power to the Fort Bliss EPEC substation (50,000 KVA capacity) from the Newman and Rio Grande generating stations. The substation reduces power to 13.2 KV and delivers power through two 13.2 KV feeders to the adjacent government-owned regulator station. Total feeder capacity from the regulator station is 5500 KVA, distributed by eight 500 KVA regulated circuits and one 1000 KVA regulated circuit feeding the Main Post, Logan Heights, and William Beaumont AMC areas, and one 500 KVA unregulated circuit supplying Biggs AAF. There are also emergency points of delivery at the Main Post and William Beaumont General Hospital. Eleven emergency standby generators are within the cantonment areas.

Electric power to all areas outside the main cantonment areas is also supplied by the El Paso Electric Company. Power is provided directly by the utility company through its facilities to all areas except Orogrande Range Camp, Dona Ana ranges, and North McGregor Range facilities, which receive power from the White Sands Missile Range distribution system. Power lines on-post are described in section L. Non-Urban Culture Features.

Future availability of electrical power from El Paso Electric Company is adequate for projected demands.

*Owned by El Paso Electric Company

**KV = kilovolts
KVA = kilovolt amperes
KWH = kilowatt hours

***Total does not equal sum of components because of interconnected systems.

# K. URBAN AREAS (CANTONMENT AREAS) (Continued)

## WATER SUPPLY

| AREA | CAPACITY | CURRENT LOAD (1977) | REMARKS |
|---|---|---|---|
| Main Post, William Beaumont AMC, Biggs AAF (excluding Van Horne Park and Aero Vista Family Housing areas) | 48,862 liters per minute (18,590,400 gallons per day)<br>Storage: 34,239,110 liters (9,046,000 gallons) | 7,914,783,220 liters (2,091,092,000 gallons) | Water supply in the main cantonment areas (with the exceptions of Logan Heights, Aero Vista Family Housing area, and Van Horne Park) is from 13 wells on the Main Post at Tobin Well Field (north of the Main Post) and Biggs AAF. Overall peak monthly demand during the last three years was 511 million liters (135 million gallons). Logan Heights, Van Horne Park, and Aero Vista Family Housing area are supplied directly from the City of El Paso distribution system.<br>There are no restrictions imposed by the City of El Paso on Fort Bliss regarding the amount of water purchases. The maximum amount purchased from the city in recent years of record was 431 million liters (114 million gallons), obtained during July 1976.<br>Available studies indicate no immediate problems regarding ground water supplies in the Fort Bliss-El Paso area; however, proper management and control of water production will be necessary to insure adequate supplies in the future. There are no plans to increase water supply sources on the installation unless the population significantly increases. At the time this study was completed, no significant change in population was expected.<br>Storage facilities consist of seven elevated tanks and nine ground storage tanks. |
| Van Horne Park | | 612,064,780 liters (161,708,000 gallons) | Van Horne Park obtains water directly from the City of El Paso Distribution System. |
| Aero Vista Family Housing Area | | 800,648,620 liters (211,532,000 gallons) | Aero Vista Family Housing Area obtains water directly from the City of El Paso Distribution System. |
| Logan Heights | Storage: 4,587,420 liters (1,212,000 gallons) | 1,590,468,335 liters (420,203,000 gallons) | Logan Heights obtains water directly from the City of El Paso Distribution System.<br>Storage facilities consist of two ground storage tanks. |
| McGregor Range Camp | Storage: 1,930,350 liters (510,000 gallons) | 218,973,605 liters (57,853,000 gallons) | Water is obtained from the City of El Paso Distribution System. There are two 946,250 liter (250,000 gallon) elevated storage tanks at the range camp. A 37,850 liter (10,000 gallon) elevated tank is at North McGregor Range. |
| Dona Ana Range Camp | 3406 liters per minute (1,296,000 gallons per day)<br>Storage: 567,750 liters (150,000 gallons) | 94,382,760 liters (24,936,000 gallons) | Water supply is obtained from two wells.<br>Storage facilities consist of one elevated storage tank. |
| Orogrande Range Camp | Storage: 757,000 liters (200,000 gallons) | 20,314,095 liters (5,367,000 gallons) | Water is obtained from White Sands Missile Range water supply.<br>Storage facilities consist of two ground storage tanks with capacities of 567,750 liters (150,000 gallons) and 189,250 liters (50,000 gallons), respectively. |
| TOTAL SUPPLY CAPACITY (From wells only): | 52,268 liters per minute (19,886,400 gallons per day) from wells only | 11,251,635,435 liters (2,972,691,000 gallons) (FY 1977) | |
| TOTAL STORAGE CAPACITY: | 42,081,630 liters (11,118,000 gallons) | | |

## SEWERAGE

The Fort Bliss sewer system within the main cantonment area consists of four collecting systems, two sewage lift stations, four trunk sewers, and one outfall sewer. Sewage is treated by the City of El Paso for the Army under a utility service sewage contract.

Sewage at Dona Ana Range Camp is treated at an oxidation pond.

McGregor and Orogrande Range Camps use Imhoff tanks and oxidation ponds for sewage treatment. The McGregor Range system has a capacity of 81 liters per minute (31,000 gallons per day).

There are no plans for expanding the current system. In general, the system is in good condition; there is little infiltration of surface water; and has adequate manholes to remove stoppages.

## TROOP BILLETS

| TYPE | NUMBER OF BUILDINGS | TOTAL CAPACITY | CURRENT LOAD | CONDITION* | REMARKS |
|---|---|---|---|---|---|
| Permanent | 64 | 9678 | | Excellent | Permanent facilities are in the Main Post, Biggs AAF, William Beaumont AMC, and Logan Heights. These structures are of concrete block construction and were built generally between 1953 and 1957. |
| Semi-Permanent | 109 | 5000 | | Excellent | The semi-permanent barracks are in the Orogrande Range, McGregor Range, Biggs AAF, and Main Post cantonments. Most were constructed between 1955 and 1960; eleven buildings within the Main Post were constructed in 1967. |
| Temporary | 109 | 1177 | | Poor to Excellent | Most of the temporary facilities are in the Dona Ana and Orogrande Range areas. Nine temporary structures, in good condition, are at Biggs AAF, and one building, in poor condition, is within the William Beaumont complex. The Dona Ana Range Camp contains 71 prefabricated metal buildings, all in excellent condition. Twelve of the 28 buildings at Orogrande Range Camp are in poor condition and are scheduled for demolition and replacement by 1988. The temporary barracks at Orogrande Range are all of quonset type design. |
| TOTAL | 282 | 15,855 | 9346 | | Data for current load are presented for the total installation because housing capacity and utilization records are not maintained according to building construction categories.<br>Utilization data available for February 1978 indicate a total of 2142 spaces diverted to other uses. Diversions include 83 spaces at the Main Post for a temporary drug abuse treatment center and 650 spaces diverted at Logan Heights (550 leased to El Paso Community College, 50 used for a dental clinic, and 50 used as an education center). Remaining diverted spaces were classified as substandard in available capacity and utilization reports. Information on specific uses is not available for these substandard spaces. |

*Building condition is determined from Estimated Economic Life (EEL) Code: Present to 1989 is poor; 1990 to 1999 is good; 2000 and beyond is excellent.

## TELECOMMUNICATIONS

| TYPE | CAPACITY | REMARKS |
|---|---|---|
| Official Telephone: | | |
| Main Post Telephone Exchange | 102 outgoing trunks; 85 incoming trunks; 15 incoming toll trunks; 6 incoming Federal Telephone System trunks; 50 Automatic Voice System (AUTOVON) lines, 31 two-way and 19 incoming only; 2-position test board; 7000 lines of automatic electric dial central office equipment; 7-position switchboard providing operator assistance for directory listings and toll service. | The Government-owned telephone system is adequate to provide administrative and range communications through 1980. |
| Satellite Exchanges | 2400 lines, 9436 telephones | Satellite exchanges are at Biggs AAF (1000 lines), McGregor Range (400 lines), Orogrande Range (200 lines), Dona Ana Range (200 lines), and William Beaumont AMC (600 lines). |
| Unofficial Telephone: | | |
| East Office | 3600 cable pairs between East Office and Fort Bliss main telephone exchange. Cable distribution on-post provided by Army-owned cable. Approximately 3300 pairs leased to Mountain Bell Telephone Company. | Service provided by the Mountain Bell Telephone Company. |
| Microwave System: | | Voice, radar, telemetry, television, and range timing transmissions are provided by an integrated microwave system. Stations are provided at two locations within the Main Post, including the main telephone exchange, and at McGregor, South McGregor, Orogrande, and Dona Ana ranges. All stations support U.S. Army Air Defense Center activities, the Air Defense Board, White Sands Missile Range, the Air Defense School, and tenant organizations. They also provide communication in support of range operations.<br>The microwave system is adequate to provide support in communications for range safety and surveillance through 1980. |
| Telecommunications Center: | | The Fort Bliss Telecommunications and Message Center is at Biggs AAF in a restricted area. Emergency power is produced by a generator in an adjacent building. The center houses teletype and cryptographic equipment connected to the Automatic Data System (AUTODIN) and processes all incoming and outgoing messages and handles all secure telephone calls.<br>The Telecommunications and Message Center is adequate to meet projected demands through 1980. |
| Military Affiliate Radio System (MARS): | | Two Military Affiliate Radio Systems (MARS) are operated by Fort Bliss. The MARS systems are adequate for existing and future requirements for emergency voice communications. |
| Television Distribution System: | | Fort Bliss operates an eight channel Educational Television Distribution System consisting of aerial and underground co-axial cable, polemounted amplifiers, splitters, and extenders. The television system is adequate for existing and known future requirements. |

# K. URBAN AREAS (CANTONMENT AREAS) (Continued)

## FAMILY HOUSING

| AREA | TYPE | NUMBER OF BUILDINGS | NUMBER OF FAMILY UNITS | CURRENT LOAD | YEAR OF CONSTRUCTION | CONDITION* |
|---|---|---|---|---|---|---|
| Main Post | General | 1 | 1 | 1 | 1910 | Good |
| | General | 2 | 2 | 2 | 1934 | Excellent |
| | Colonel | 36 | 36 | 29 | 1934 | Excellent |
| | Lt. Colonel & Major | 36 | 36 | 36 | 1893-1914 | Good |
| | Lt. Colonel & Major | 11 | 22 | 22 | 1956 | Excellent |
| | Lt. Colonel & Major | 40 | 40 | 40 | 1961 | Excellent |
| | CGO/WO | 73 | 73 | 73 | 1960 | Excellent |
| | CGO/WO | 70 | 140 | 140 | 1961 | Excellent |
| | NCO | 103 | 103 | 103 | 1930-1949 | Excellent |
| | NCO | 267 | 267 | 267 | 1950-1956 | Excellent |
| | NCO | 36 | 36 | 36 | 1956-1959 | Excellent |
| Van Horne Park (Part of Main Post) | Lt. Colonel & Major | 29 | 29 | 29 | 1951 | Excellent |
| | CGO/WO | 216 | 273 | 273 | 1951 | Excellent |
| | NCO | 124 | 496 | 496 | 1951 | Excellent |
| Logan Heights | NCO | 9 | 9 | 9 | 1962 | Excellent |
| | NCO | 217 | 434 | 434 | 1961-1962 | Excellent |
| | NCO | 3 | 6 | 6 | 1971 | Excellent |
| William Beaumont AMC | General | 1 | 1 | 1 | 1922 | Poor |
| | Lt. Colonel & Major | 10 | 11 | 10 | 1921-1923 | Poor |
| | Lt. Colonel & Major | 5 | 5 | 5 | 1948-1959 | Excellent |
| | Lt. Colonel & Major | 7 | 14 | 14 | 1948 | Excellent |
| | CGO/WO | 20 | 40 | 40 | 1959 | Excellent |
| | NCO | 11 | 11 | 11 | 1922-1923 | Poor |
| | NCO | 40 | 80 | 80 | 1959 | Excellent |
| Biggs AAF | Colonel | 10 | 10 | 10 | 1951 | Excellent |
| | Lt. Colonel & Major | 87 | 87 | 87 | 1951 | Excellent |
| | CGO/WO | 33 | 33 | 33 | 1951 | Excellent |
| | NCO | 70 | 70 | 70 | 1951 | Excellent |
| TOTAL | | 2507 | 3582 | 3574 | | |

*Building condition is determined from Estimated Economic Life (EEL) Code: Present to 1989 is poor; 1990 to 1999 is good; 2000 and beyond is excellent.

### REMARKS

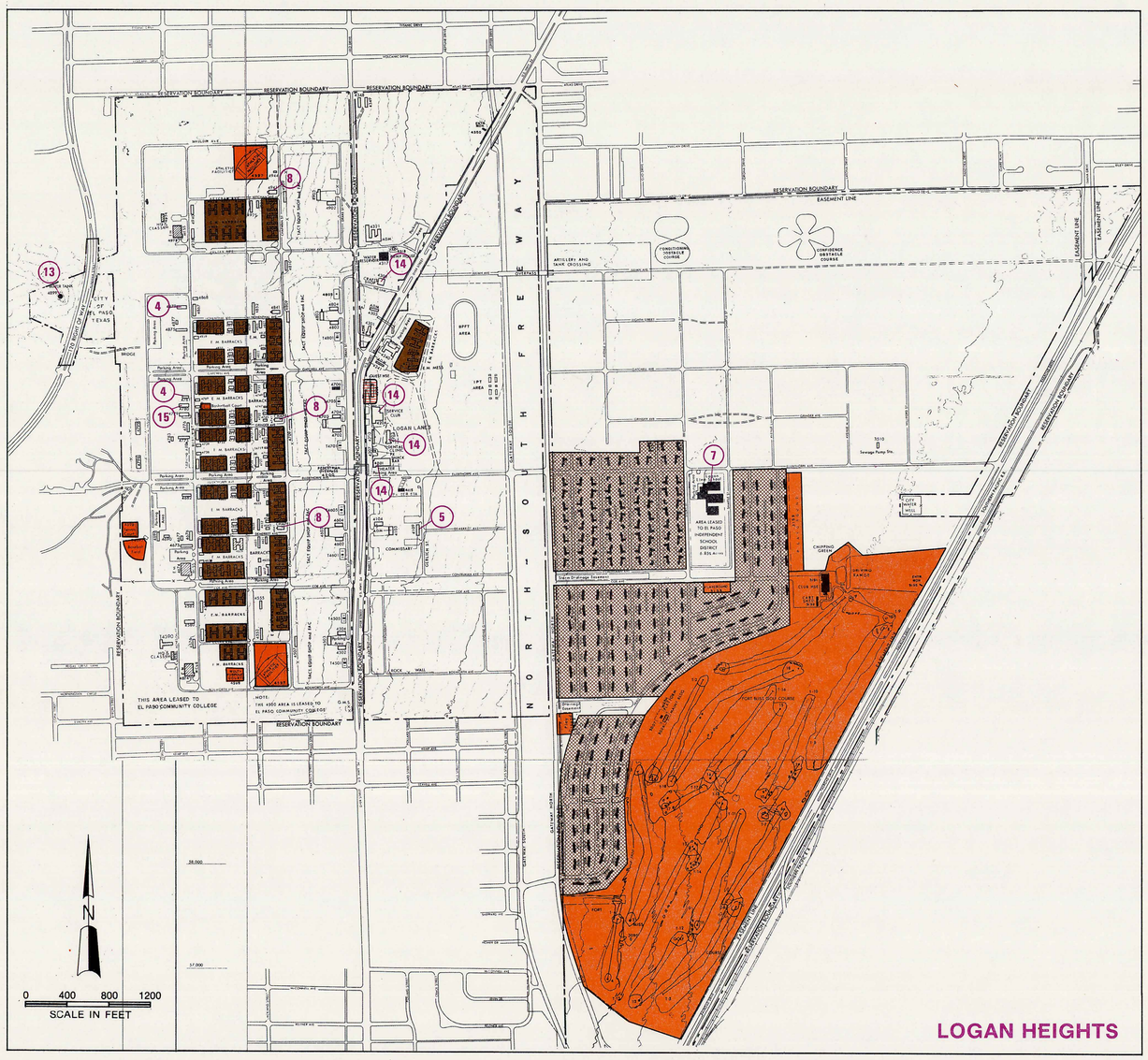
Family housing at Fort Bliss is in the Main Post and the closely associated Logan Heights, William Beaumont AMC, and Biggs AAF cantonment areas. Most of the units contain either two or three bedrooms, but a limited number of four and five bedroom units also exist.

Enlisted men's family housing accounts for approximately 70 percent of the total family housing units. Duplex structures are the most common type of building design, making up 56 percent of the total units. The remaining homes are single-family structures with the exception of 496 quadruplex units in Van Horne Park in the eastern portion of the Main Post.

Off-post housing has played and will probably continue to play a significant role in the provision of family units for personnel stationed at Fort Bliss.

There are, in addition, 211 prefabricated housing units in Kelly Park in the northwestern part of the Main Post. These units are not government-owned, but were built in 1949 and 1950 on government land by married military personnel. The Kelly Park Housing Association manages the area, renting homes to married military personnel who are either unable or ineligible to occupy other on-post quarters. The government rents the land to current occupants and provides utility and refuse collection services for a monthly fee.

All family units are usually occupied and vacancies are filled very rapidly. The master plan proposes additional units in the Logan Heights and William Beaumont AMC areas, but no new family housing construction is programmed for the next five years.




LOGAN HEIGHTS

**AREA FEATURES**

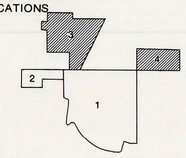
- Family Housing, Officers
- Family Housing, NCO
- Barracks, Troop Quarters
- BOQ, Male
- Guest Quarters
- Outdoor Recreation Facilities

**POINT FEATURES**

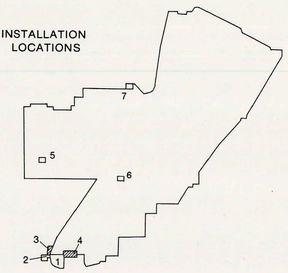
- 3 Officers Open Mess
- 4 Post Exchange & Branch PXs
- 5 Commissary
- 6 Post Office
- 7 Elementary School
- 8 Chapel
- 10 Telephone Exchange
- 13 Flight Obstruction
- 14 Indoor Recreation Facilities
- 15 Museums And Libraries
- 16 Heating Plant

**LOCATION MAPS**

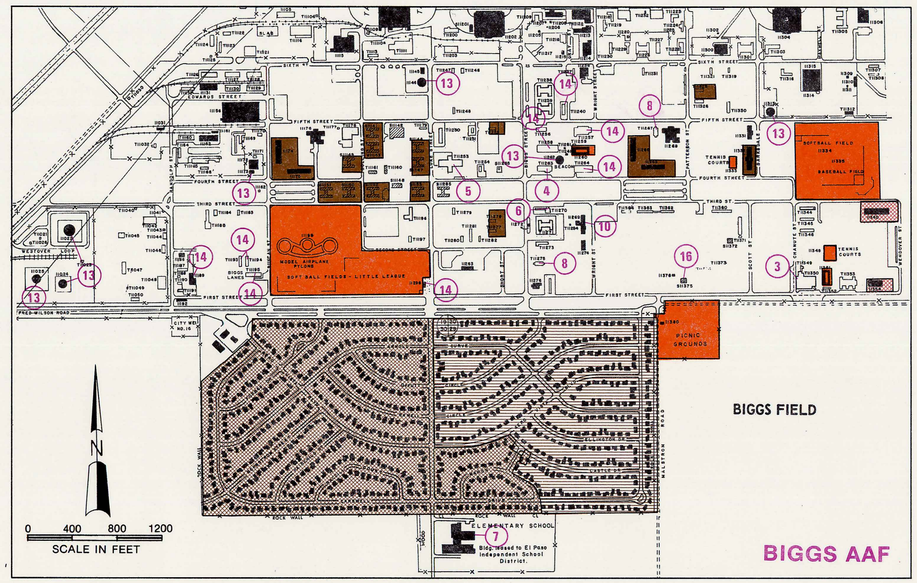
MAIN CANTONMENT LOCATIONS




INSTALLATION LOCATIONS



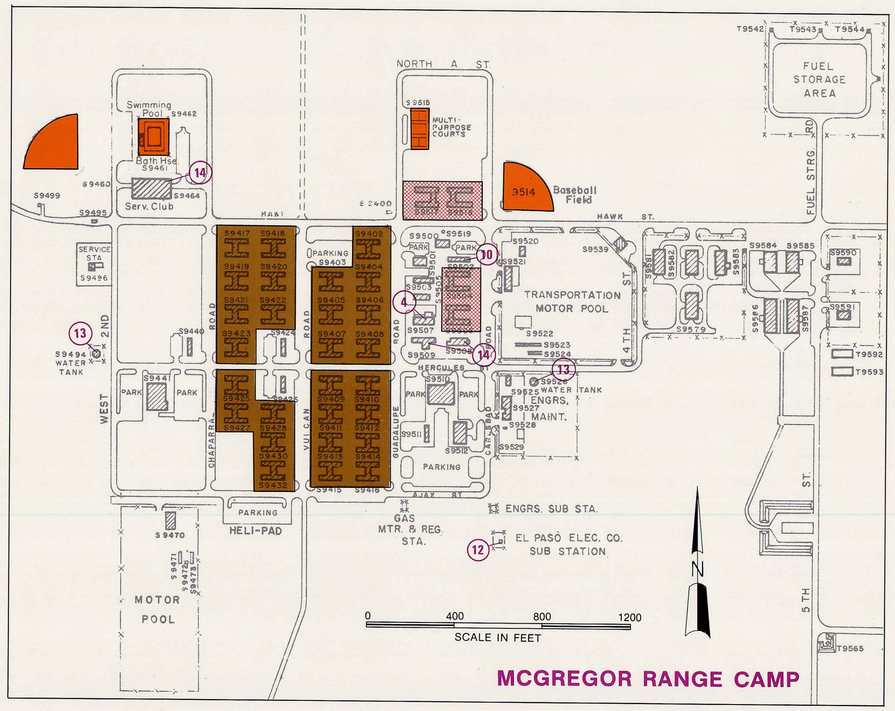

1. Main Post
2. W Beaumont AMC
3. Logan Heights
4. Biggs AAF
5. Dona Ana Range Camp
6. McGregor Range Camp
7. Orogrande Range Camp




BIGGS FIELD

BIGGS AAF

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.




## MCGREGOR RANGE CAMP

### AREA FEATURES

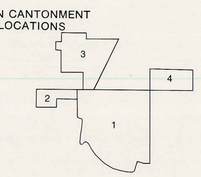
- Barracks, Troop Quarters
- BOQ, Male
- Outdoor Recreation Facilities

### POINT FEATURES

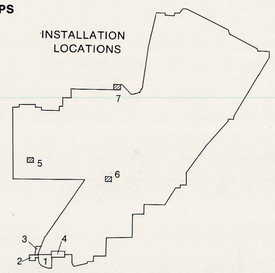
- (4) Post Exchange & Branch PXs
- (10) Telephone Exchange
- (12) Electric Power Substation
- (13) Flight Obstruction
- (14) Indoor Recreation Facilities

### LOCATION MAPS

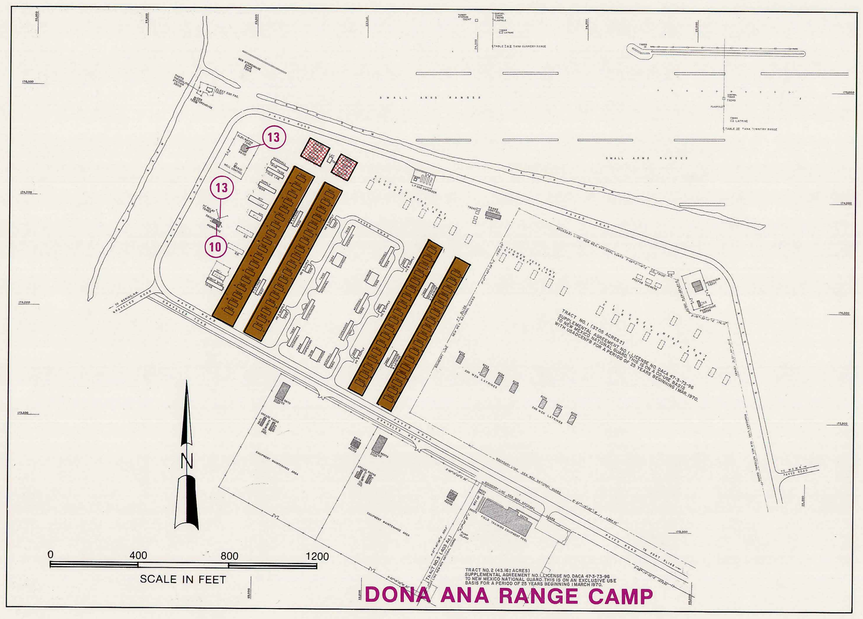
MAIN CANTONMENT LOCATIONS



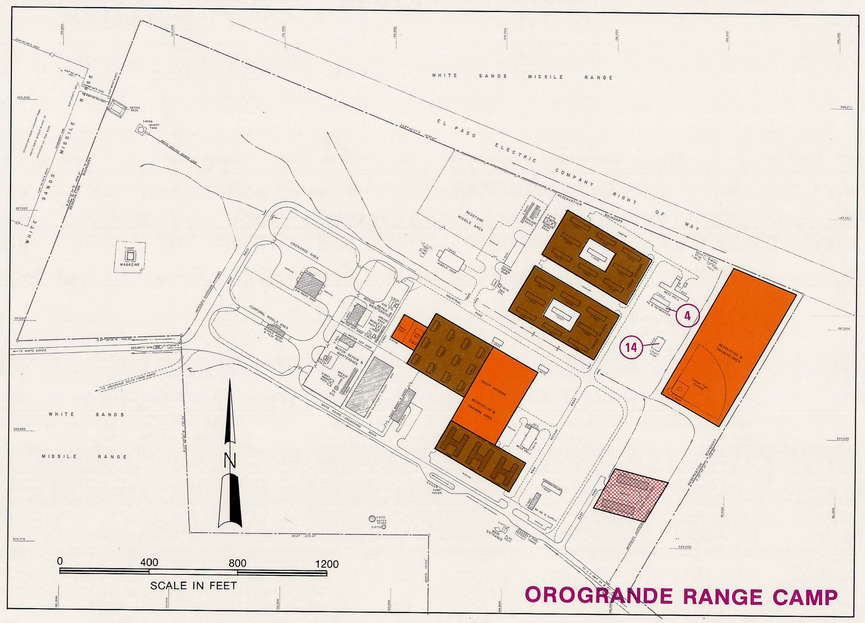

INSTALLATION LOCATIONS




1. Main Post
2. W Beaumont AMC
3. Logan Heights
4. Biggs AAF
5. Dona Ana Range Camp
6. McGregor Range Camp
7. Orogrande Range Camp




## DONA ANA RANGE CAMP




## OROGRANDE RANGE CAMP

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# K. URBAN AREAS (CANTONMENT AREAS)

# L. NON-URBAN CULTURE FEATURES

Fort Bliss contains at least 580 sites with manmade features outside of the cantonment areas which could positively or negatively affect military training or operations; these were compiled in January 1978. The manmade features are concentrated in the vicinity of the McGregor, Dona Ana, and Orogrande range camps, in the area just north of Biggs Army Airfield, in Maneuver Area Two (Hot Wells Ranch), on Otero Mesa (Bureau of Land Management), and adjacent to White Sands Missile Range. Those in Maneuver Area Two and on Otero Mesa are mostly associated with cattle ranching.

Some of these features, such as fences, utility lines and "water storage tanks", are numerous or cover extensive areas. Fences, most of which have four-strands of barbed wire, total 577.4 kilometers (358.8 miles) in length. Utility lines of all types total 514.6 kilometers (319.8 miles). Many other features associated with ranching prior to the acquisition of range land are in ruins and are becoming less visible. The term, "water storage tanks", is used to describe small impoundments created by earthen dams or by pits dug to hold water, in addition to metal and concrete tanks of various sizes and shapes. "Tub" is often used interchangeably with "tank" to describe small, shallow, metal or concrete water storage containers from which cattle generally drink.

Preliminary evaluation of archaeological inventories and sampling indicates that an estimated 16,000 archaeological sites representing at least 11,000 years of prehistory and history are present on Fort Bliss. Some archaeological site areas are currently restricted by the installation commander and are not used for maneuvers or training. Planning for future use of the installation will be influenced by the relatively extensive prehistorical and historical resource base, as required by federal law.

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 1 | 800202 to 007410 | 1 | Fence,[1] length 21.7 km (13.5 mi) |
| 2 | 970411 to 955456 | 1 | Fence,[1] length 6 km (3.7 mi) |
| 3 | 889483 | 1 | Fenced area,[2] 18,812m² (202,500 ft²) |
| 4 | 230654 | 3 | Dirt water storage tank, abandoned |
| 5 | 900295 | 1 | Earth berm, length 850m (2789 ft), abandoned |
| 6 | 781500 to 542504 | 1-2 | Fence,[1] length 23.6 km (14.7 mi) |
| 7 | 533504 to 510632 | 2 | Fence,[1] length 15.1 km (9.4 mi) |
| 8 | 510643 to 513759 | 2 | Fence,[1] length 11.4 km (7.1 mi) |
| 9 | 620782 to 670777 | 2 | Fence, combination chain link[2] and barbed wire,[1] length 5.5 km (3.4 mi) |
| 10 | 933846 to 959786 | 2-3 | Fence,[1] length 8.8 km (5.5 mi) |
| 11 | 046409 to 037995 | 1-3-4 | Fence,[1] length 162.5 km (101 mi): runs off the reservation in several places and is not shown on map, but is continuous between listed grid references. |
| 12 | 491978 to 507995 | 4 | Fence,[1] length 2.4 km (1.5 mi) |
| 13 | 347073 to 300098 | 4 | Fence,[1] length 6.9 km (4.3 mi) |
| 14 | 300108 to 240140 | 4 | Fence,[1] length 8.5 km (5.3 mi) |
| 15 | 804371 to 812371 to 812363 to 804363 to origin | 1 | Fence,[1] length 3.2 km (2 mi) |
| 16 | 800255 to 904297 | 1 | Fence,[1] length 7.2 km (4.5 mi) |
| 17 | 800202 to 863289 | 1 | Fence,[1] length 14.5 km (9 mi) |
| 18 | 862288 to 888284 | 1 | Fence,[1] length 2.4 km (1.5 mi) |
| 19 | 871288 to 869293 | 1 | Fence,[1] length 0.5 km (0.3 mi) |
| 20 | 937411 to 948372 | 1 | Fence,[1] length 4 km (2.5 mi) |
| 21 | 941411 to 952376 | 1 | Fence,[1] length 4.5 km (2.8 mi) |
| 22 | 948372 to 955374 and 955374 to 952376 and 955374 to 963374 | 1 | Fence,[1] length 2.1 km (1.3 mi) |
| 23 | 972374 to 994410 | 1 | Fence,[1] length 5.1 km (3.2 mi) |
| 24 | 924527 to 928528 to 929524 to 925523 to origin | 3 | Fence,[2] length 1.1 km (0.7 mi) |
| 25 | 170158 to 170165 | 4 | Fence,[1] length 0.6 km (0.4 mi) |
| 26 | 199569 to 303933 | 3-4 | Fence,[1] length 56.8 km (35.3 mi) |
| 27 | 203687 to 293687 | 3 | Fence,[1] length 8.8 km (5.5 mi) |
| 28 | 285687 to 187077 | 3-4 | Fence,[1] length 52.9 km (32.9 mi) |
| 29 | 213806 to 284789 | 3 | Fence,[1] length 7.7 km (4.8 mi) |
| 30 | 285767 to 365895 | 3-4 | Fence,[1] length 17.2 km (10.7 mi) |
| 31 | 333789 to 392780 | 3 | Fence,[1] length 6.1 km (3.8 mi) |
| 32 | 284847 to 341830 | 3 | Fence,[1] length 6.1 km (3.8 mi) |
| 33 | 406846 to 425846 to 425876 to 415876 to 407866 to origin | 3-4 | Fence,[1] length 8.4 km (5.2 mi) |
| 34 | 418876 to 443019 | 4 | Fence,[1] length 18 km (11.2 mi) |
| 35 | 303932 to 418895 | 4 | Fence,[1] length 9.7 km (6 mi) |
| 36 | 238973 to 415942 | 4 | Fence,[1] length 20.8 km (12.9 mi) |
| 37 | 308027 to 443017 | 4 | Fence,[1] length 16.6 km (10.3 mi) |
| 38 | 287990 to 298073 | 4 | Fence,[1] length 10.9 km (6.8 mi) |
| 39 | 331085 | 4 | At Rim Tank: Metal water storage tank; cattle watering trough. |
| 40 | 333060 | 4 | At Powell Tank: Metal water storage tank; cattle watering trough. |
| 41 | 348045 | 4 | At Hamilton Tank: Cattle watering trough. |
| 42 | 215633 | 3 | At Wet Weather Pond: Dirt water storage tank. |
| 43 | 265678 | 3 | At Tripod Tank: Dirt water storage tank; metal water storage tank; cattle watering trough. |
| 44 | 257670 | 3 | Cattle watering trough |
| 45 | 249663 | 3 | Cattle watering trough |
| 46 | 239658 | 3 | Cattle watering trough |
| 47 | 276702 | 3 | At Corner Tanks: Two dirt water storage tanks. |
| 48 | 245692 | 3 | Cattle watering trough |
| 49 | 233721 | 3 | Cattle watering trough |
| 50 | 219728 | 3 | At Martin Tank: Dirt water storage tank; windpump, height 9 m (30 ft), ruin. |
| 51 | 267729 | 3 | Cattle watering trough |
| 52 | 218753 | 3 | Cattle watering trough |
| 53 | 202792 | 3 | At West Rim Tank: Two metal water storage tanks; cattle watering trough. |
| 54 | 271750 | 3 | At Big Tank: Two dirt water storage tanks. |
| 55 | 286749 | 3 | At End-of-Line Number Two Tank: Cattle watering trough; corral. |
| 56 | 285750 | 3 | At End-of-Line Number One Tank: Cattle watering trough; corral. |
| 57 | 285752 | 3 | At End-of-Line Rim Tank: Dirt water storage tank; metal water storage tank. |
| 58 | 302742 | 3 | At End-of-Line Number Three Tank: Cattle watering trough. |
| 59 | 313742 | 3 | At End-of-Line Number Four Tank: Cattle watering trough. |
| 60 | 308741 | 3 | Dirt water storage tank |
| 61 | 286779 | 3 | At Mare Pasture Rim Tank: Metal water storage tank. |
| 62 | 288786 | 3 | At Herd Pasture Tub: Cattle watering trough. |
| 63 | 283787 | 3 | At Mare Pasture Tub: Metal water storage tank; cattle watering trough. |
| 64 | 282795 | 3 | At South Tank: Cattle watering trough. |
| 65 | 244787 | 3 | At Mesa Number Two Tank: Cattle watering trough. |
| 66 | 242795 | 3 | At Mesa Number One Tank: Cattle watering trough. |
| 67 | 333790 | 3 | At Cockleburr Lake: Cattle watering trough. |
| 68 | 383823 | 3 | At Mary Toy Tank: Dirt water storage tank; metal water storage tank; well, diesel powered pump, capacity 30 to 38 liters per min (11,520 to 14,400 gal per day). |
| 69 | 380831 | 3 | Cattle watering trough |
| 70 | 356839 | 3 | Cattle watering trough |
| 71 | 336851 | 3-4 | At Gyp Tank: Dirt water storage tank; cattle watering trough. |
| 72 | 400832 | 3 | At Guard Post Number Two: Metal Butler building, 13 m² (140 ft²), portable. |
| 73 | 284849 | 3 | At Mesa Horse Camp: Dirt water storage tank; metal water storage tank; corral. |
| 74 | 291845 | 3 | Cattle watering trough |
| 75 | 303842 | 3 | Cattle watering trough |
| 76 | 326827 | 3 | At Bear Tank: Cattle watering trough. |
| 77 | 355830 | 3 | At Payne Tank: Dirt water storage tank; building, ruin. |
| 78 | 269839 | 3 | At West Tank: Dirt water storage tank. |
| 79 | 239828 | 3 | At Little Tank: Dirt water storage tank. |
| 80 | 180541 | 3 | At Escondida Tank: Dirt water storage tank, abandoned. |
| 81 | 167580 | 3 | At Owl Tanks: Two dirt water storage tanks, abandoned. |
| 82 | 192634 | 3 | Dirt water storage tank, abandoned |
| 83 | 161563 | 3 | At Foster Ranch: Two dirt water storage tanks, abandoned; metal water storage tank, abandoned; house, abandoned. |
| 84 | 142564 | 3 | At Chiles Tank: Dirt water storage tank, dam length 107 m (350 ft), base width 15 m (50 ft), height 3 m (10 ft), abandoned; four corrals, abandoned; poultry house, 149 m² (1600 ft²), wooden, ruin; ranch house, 68 m² (729 ft²), wood and rock, ruin; cistern, cement, abandoned; barn, 39 m² (420 ft²), wooden, ruin. |
| 85 | 118572 | 3 | At Castner West Tank: Dirt water storage tank, dam length 128 m (420 ft), base width 10 m (32 ft), height 2 m (5 ft), abandoned; silt trap shows as separate tank on maps, abandoned. |
| 86 | 071573 | 3 | At Grey Tank: Dirt water storage tank, abandoned; building, ruin. |
| 87 | 084517 | 3 | At Hackberry Tank: Dirt water storage tank, abandoned. |
| 88 | 055526 | 3 | At Charley Tank: Dirt water storage tank, abandoned. |
| 89 | 038557 | 3 | At School Tank: Concrete water storage tank, abandoned. |
| 90 | 038535 | 3 | Building, ruin |
| 91 | 013524 | 3 | At Flat Tank: Dirt water storage tank, abandoned; corral, abandoned; two metal water storage tanks, abandoned. |
| 92 | 758308 | 1 | Metal Butler building, 13 m² (140 ft²), portable |
| 93 | 986541 | 3 | At Chaparral Tank: Two dirt water storage tanks, abandoned. |
| 94 | 452979 | 4 | House, ruin; corral, abandoned; barn, ruin |
| 95 | 227963 | 4 | House, 11 m² (120 ft²), wooden, abandoned; cistern, cement, abandoned. |
| 96 | 958517 | 3 | At Big Tank: Concrete water storage tank, abandoned. |
| 97 | 815479 | 1 | At Magazine Area 9900: Administrative building, 14 m² (152 ft²), wooden, temporary; storehouse, 36 m² (384 ft²), steel; sentry box, wooden, temporary; six guided missile magazines;[3] guided missile magazine, 40 m² (425 ft²), concrete, earth covered, semi-permanent; guided missile magazine, 626 m² (6737 ft²), concrete block, earth covered, semi-permanent; storage shed, 18 m² (197 ft²), concrete block, semi-permanent; security fence.[2] |
| 98 | 910579 | 3 | At Alvarado Number One Tank: Dirt water storage tank, abandoned. |
| 99 | 956596 | 3 | At Alvarado Number Two Tank: Dirt water storage tank, abandoned. |
| 100 | 987590 | 3 | Steel water storage tank, abandoned |
| 101 | 986594 | 3 | At Borrego Tank: Dirt water storage tank, abandoned. |
| 102 | 988682 | 3 | At South Well: Concrete water storage tank, abandoned; well, depth 198 m (650 ft), abandoned; Samson windpump, height 6 m (18 ft), ruin; house, 46 m² (490 ft²), wooden, ruin; cistern, concrete, abandoned; garage, 21 m² (224 ft²), wooden, ruin; two concrete cattle watering troughs, abandoned; six corrals, abandoned. |
| 103 | 111606 | 3 | At Campbell Tank: House, 120 m² (1289 ft²), wooden, ruin; cistern, concrete, abandoned; storeroom, 21 m² (224 ft²), rock, ruin; poultry house and privy, 9 m² (99 ft²), ruin; feed house, 13 m² (144 ft²), galvanized iron and wood, ruin; six corrals, abandoned; dirt water storage tank, dam length 192 m (630 ft), base width 15 m (50 ft), height 2 m (8 ft). |
| 104 | 150588 | 3 | Dirt water storage tank, abandoned |
| 105 | 155630 | 3 | At Green Tank (also known as Buck Tank): Dirt water storage tank, double berm, each dam length 46 m (150 ft), base width 20 m (65 ft), height 2 m (6 ft), abandoned. |
| 106 | 142666 | 3 | At Broyle Tank: Dirt water storage tank, dam length 192 m (630 ft), base width 18 m (60 ft), height 1 m (3 ft), abandoned. |
| 107 | 072660 | 3 | At Tinney Tank: Dirt water storage tank, dam length 265 m (870 ft), base width 14 m (45 ft), height 3 m (10 ft), abandoned; three corrals, abandoned. |
| 108 | 548645 to 557665 | 2 | Direct buried (underground) power cable, one number two aluminum, 15 kv, single phase |
| 109 | 054695 | 3 | At Road Tank: Dirt water storage tank, dam length 146 m (480 ft), base width 18 m (60 ft), height 2 m (6 ft), abandoned. |
| 110 | 049627 | 3 | At South Tank: Dirt water storage tank, dam length 287 m (940 ft), base width 12 m (40 ft), height 2 m (8 ft), abandoned. |
| 111 | 043737 | 3 | Windpump, ruin; two steel water storage tanks, abandoned |
| 112 | 119732 | 3 | At Little Mack Tank: Dirt water storage tank, dam length 122 m (400 ft), base width 11 m (35 ft), height 2 m (8 ft), abandoned. |
| 113 | 043742 | 3 | At Sulphur Well: Dirt water storage tank, dam length 168 m (550 ft), base width 18 m (60 ft), height 2 m (6 ft), abandoned; well, abandoned; Standard windpump, ruin; cistern, concrete, abandoned; two concrete water storage tanks, abandoned; house, 20 m² (210 ft²), wooden, ruin; four corrals, abandoned. |
| 114 | 090772 | 3 | At Middle Tank: Dirt water storage tank, dam length 175 m (575 ft), base width 12 m (40 ft), height 2 m (8 ft), abandoned. |
| 115 | 174784 | 3 | At Hay Meadow Tank: Dirt water storage tank, double berm, each dam length 186 m (610 ft), base width 18 m (60 ft), height 2 m (6 ft), abandoned; four corrals, abandoned. |
| 116 | 121821 | 3 | At Little Crockett Tank: Dirt water storage tank, abandoned. |
| 117 | 990790 | 2-3 | Metal water storage tank, abandoned |
| 118 | 048822 | 3 | At McGregor Ranch: House, 147 m² (1580 ft²), wooden, ruin; cistern, concrete, abandoned; two poultry houses, ruins; two privies, pit type, abandoned; shed-garage, 29 m² (308 ft²), ruin; barn and shed 111 m² (1192 ft²), ruin; 14 corrals and pens, abandoned; two cattle loading chutes, abandoned; four cattle watering troughs, abandoned; two metal water storage tanks, abandoned; windpump, ruin; blacksmith shop, 22 m² (231 ft²), ruin; storeroom, 98 m² (1055 ft²), ruin. |
| 119 | 043845 | 3 | At Benton Well: Samson windpump, height 12 m (40 ft), stub tower, wooden, ruin; well, depth 152 m (500 ft), abandoned; pump house, 21 m² (225 ft²), abandoned; cattle watering trough, abandoned; dirt water storage tank, abandoned; metal water storage tank, abandoned. |
| 120 | 115870 | 4 | At CCC Tank (also known as Oil Well Tank): Metal water storage tank, abandoned; dirt water storage tank, dam length 168 m (550 ft), base width 12 m (40 ft), height 2 m (8 ft), abandoned; cattle watering trough, abandoned; well, depth 533 m (1750 ft); Challenge windpump, ruin. |
| 121 | 069899 | 4 | At Wilde Tank: Dirt water storage tank, dam length 213 m (700 ft), base width 12 m (40 ft), height 3 m (10 ft), abandoned. |
| 122 | 068901 | 4 | At Wilde Well: House, 29 m² (308 ft²), wooden, ruin; well, depth 70 m (230 ft), abandoned; windpump, height 12 m (40 ft), stub tower, ruin; feed house, 6 m² (63 ft²), ruin; metal water storage tank, abandoned; two concrete cattle watering troughs, abandoned; five corrals, abandoned. |
| 123 | 004403 | 1 | Ranch house, wooden, ruin |
| 124 | 020442 | 1 | Dirt water storage tank, abandoned; house, ruin; two corrals, abandoned |
| 125 | 166916 | 4 | At Pendejo Tank: Dirt water storage tank, abandoned. |
| 126 | 133932 | 4 | At Lee Tank: Dirt water storage tank, abandoned. |
| 127 | 128009 | 4 | At Camp Windy Water: Three metal water storage tanks; cattle watering trough. |

# L. NON-URBAN CULTURE FEATURES (Continued)

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 128 | 150939 | 4 | At Wright Tank: Dirt water storage tank, abandoned. |
| 129 | 155938 | 4 | At Old Wright Place Ranch: House, ruin. |
| 130 | 159968 | 4 | Dirt water storage tank, abandoned |
| 131 | 162968 | 4 | Dirt water storage tank, abandoned |
| 132 | 164969 | 4 | Dirt water storage tank, abandoned |
| 133 | 119964 | 4 | Windpump, ruin |
| 134 | 050060 to 139060 | 4 | Fence,[1] length 8.8 km (5.5 mi) |
| 135 | 232972 | 4 | At Spring Tank: Dirt water storage tank. |
| 136 | 073976 | 4 | At Cox Well: Windpump, height 9 m (30 ft), ruin; house, ruin; metal water storage tank, abandoned; three watering troughs, abandoned. |
| 137 | 127046 | 4 | Dirt water storage tank, abandoned |
| 138 | 315860 | 4 | At Gramma Tank: Cattle watering trough. |
| 139 | 221873 | 4 | At Broke Tank: Dirt water storage tank. |
| 140 | 291880 | 4 | At Godfrey Tank: Dirt water storage tank. |
| 141 | 253895 | 4 | At Double Tanks: Two dirt water storage tanks; two cattle watering troughs. |
| 142 | 245927 | 4 | At Road Tank: Dirt water storage tank. |
| 143 | 272905 | 4 | At Middle Wingfield Tank: Dirt water storage tank, abandoned. |
| 144 | 297917 | 4 | At Wingfield Tank: Metal water storage tank; two cattle watering troughs. |
| 145 | 327907 | 4 | At Gravel Tanks: Two dirt water storage tanks. |
| 146 | 339921 | 4 | At Number 506 Tubs: Two cattle watering troughs. |
| 147 | 354906 | 4 | Metal water storage tank; cattle watering trough |
| 148 | 353887 | 4 | Cattle watering trough |
| 149 | 370879 | 4 | Cattle watering trough |
| 150 | 381873 | 4 | Cattle watering trough |
| 151 | 418877 | 4 | At Prather Tanks: Two dirt water storage tanks; metal water storage tank; windpump; well; corral; cattle watering trough. |
| 152 | 421878 | 4 | At Prather Ranch: Tool shed, well house, barn, and garage, ruins; grave of John Prather, cinderblock enclosed; two metal buildings; two stone buildings; metal water storage tank; well, diesel powered pump, capacity 30 to 38 liters per min (11,520 to 14,400 gal per day); two dirt water storage tanks; ten corrals. |
| 153 | 451954 | 4 | Goforth grave, no headstone, three juniper posts, height 1 m (4 ft) |
| 154 | 400923 | 4 | At Van Winkle Tank: Dirt water storage tank. |
| 155 | 448947 | 4 | At Guard Post Number Three: Metal Butler building, 13 $m^2$ (140 $ft^2$), portable. |
| 156 | 452960 | 4 | At Daggar Tank: Dirt water storage tank. |
| 157 | 343944 | 4 | At Rutherford Tank: Dirt water storage tank. |
| 158 | 304937 | 4 | At Jiggs Tank: Cattle watering trough. |
| 159 | 320953 | 4 | Dirt water storage tank |
| 160 | 329957 | 4 | Dirt water storage tank |
| 161 | 391953 | 4 | Dirt water storage tank |
| 162 | 263962 | 4 | At West Poe Tank: Dirt water storage tank; cattle watering trough. |
| 163 | 295960 | 4 | At Middle Poe Tank: Dirt water storage tank. |
| 164 | 312966 | 4 | At East Poe Tank: Metal water storage tank; cattle watering trough. |
| 165 | 315970 | 4 | At Rutherford Tap Tank: Dirt water storage tank, abandoned; cattle watering trough, abandoned. |
| 166 | 317990 | 4 | At Wildcat Tank: Cattle watering trough. |
| 167 | 319008 | 4 | At Wildlife Tank: Two cattle watering troughs. |
| 168 | 331013 | 4 | At Munson Tank: Cattle watering trough. |
| 169 | 374934 | 4 | Cattle watering trough |
| 170 | 374958 | 4 | Cattle watering trough |
| 171 | 371973 | 4 | Metal water storage tank |
| 172 | 363987 | 4 | At El Paso Tank: Cattle watering trough. |
| 173 | 369002 | 4 | At Sheep Tank: Metal water storage tank; cattle watering trough. |
| 174 | 378005 | 4 | At Silver Water Tank: Metal water storage tank; cattle watering trough. |
| 175 | 381010 | 4 | At Kirk Tank: Cattle watering trough. |
| 176 | 379023 | 4 | At Railroad Tank: Cattle watering trough. |
| 177 | 392016 | 4 | At Lee Tank: Metal water storage tank; cattle watering trough; corral; ranch house. |
| 178 | 393016 | 4 | Two cattle watering troughs |
| 179 | 404015 | 4 | At Corn Tank: Metal water storage tank; cattle watering trough. |
| 180 | 403000 | 4 | Metal water storage tank; cattle watering trough |
| 181 | 416991 | 4 | At Crest Garden Tank: Dirt water storage tank. |
| 182 | 394032 | 4 | At Lower Sombrero Tank: Metal water storage tank; cattle watering trough. |
| 183 | 397026 | 4 | Cattle watering trough |
| 184 | 368033 | 4 | At Gresik Tank: Metal water storage tank. |
| 185 | 308028 | 4 | At West Tank: Metal water storage tank; cattle watering trough. |
| 186 | 283023 | 4 | At Culp Rim Tank: Metal water storage tank. |
| 187 | 279021 | 4 | At Culp Number One Tank: Cattle watering trough. |
| 188 | 271013 | 4 | At Culp Number Two Tank: Cattle watering trough. |
| 189 | 248018 | 4 | At Culp Number Three Tank: Metal water storage tank; cattle watering trough. |
| 190 | 244019 | 4 | At Culp Number Four Tank: Cattle watering trough. |
| 191 | 240020 | 4 | At Culp Number Five Tank: Dirt water storage tank; cattle watering trough. |
| 192 | 259083 | 4 | Dirt water storage tank; cattle loading ramp, wooden, abandoned; building 42 $m^2$ (450 $ft^2$), ruin |
| 193 | 245078 | 4 | Dirt water storage tank, abandoned |
| 194 | 244081 | 4 | Two cattle feed sheds, each 13 $m^2$ (144 $ft^2$), ruins |
| 195 | 243082 | 4 | Metal water storage tank, ruin |
| 196 | 242081 | 4 | Ranch house, 112 $m^2$ (1200 $ft^2$), adobe, ruin; metal water storage tank, ruin |
| 197 | 185060 | 4 | At Sand Tub: Metal water storage tank; cattle watering trough. |
| 198 | 143084 | 4 | At Boone Tank: Two dirt water storage tanks. |
| 199 | 167088 | 4 | Building, ruin |
| 200 | 071083 | 4 | At Escondida Tank: Dirt water storage tank. |
| 201 | 114088 | 4 | At Redhead/Roadrunner Range Facility, abandoned, (also known as Rose Well): Windpump, height 9 m (30 ft), ruin; two concrete missile launch pads, 56 $m^2$ (600 $ft^2$), abandoned; concrete bunker, 84 $m^2$ (900 $ft^2$), abandoned. |
| 202 | 113090 | 4 | Fueling station pad, concrete, 37 $m^2$ (400 $ft^2$), abandoned; elevated metal water storage tank, height 9 m (30 ft), capacity 18,925 liters (5000 gal), ruin |
| 203 | 111091 | 4 | Concrete pad, 21 $m^2$ (225 $ft^2$), abandoned |
| 204 | 110090 | 4 | Fixed charge ammunition storage bunker, 9 $m^2$ (100 $ft^2$), concrete, abandoned |
| 205 | 109089 | 4 | Concrete pad, 56 $m^2$ (600 $ft^2$), abandoned |
| 206 | 108088 | 4 | Concrete pad, 56 $m^2$ (600 $ft^2$), abandoned |
| 207 | 391975 | 4 | Dirt water storage tank |
| 208 | 121106 | 4 | At Sand Tank: Dirt water storage tank. |
| 209 | 123136 | 4 | At Langford Well: Chicago Aeromotor windpump, 3 m (10 ft) fan, height 9 m (30 ft), capacity 11 to 19 liters per min (4320 to 7200 gal per day); metal water storage tank; corral; three cattle watering troughs; building, ruin. |
| 210 | 098144 | 4 | At Tony Tank: Dirt water storage tank. |
| 211 | 148145 | 4 | At Fish Tank: Chicago Aerometer windpump, 3 m (10 ft) fan, height 9 m (30 ft), capacity 11 to 19 liters per min (4320 to 7200 gal per day); dirt water storage tank; metal water storage tank; cattle watering trough. |
| 212 | 185150 | 4 | Dirt water storage tank; cattle loading chute; corral |
| 213 | 083155 | 4 | Cattle watering trough, abandoned |
| 214 | 139497 | 1 | At Ivan Grey Tank: Dirt water storage tank. |
| 215 | 812268 | 1 | Hells Hole Well, abandoned |
| 216 | 834311 | 1 | At Soldier Point Tub: Metal water storage tank. |
| 217 | 820261 | 1 | Metal water storage tank[4] |
| 218 | 866290 | 1 | At Nations East Well: Windpump; well, capacity 57 liters per min (21,600 gal per day); corral; two metal water storage tanks; two buildings, each 56 $m^2$ (600 $ft^2$), wooden. |
| 219 | 788247 | 1 | McElroy Well, abandoned |
| 220 | 878311 | 1 | Two utility poles[5] |
| 221 | 911480 | 1 | Metal water storage tank, abandoned |
| 222 | 932413 | 1 | At Hot Well: Metal water storage tank, abandoned; cattle watering trough, ruin; ranch house, wooden, ruin; storage building, adobe, ruin; windpump, ruin; three corrals, abandoned. |
| 223 | 876300 | 1 | At Curve Tank: Dirt water storage tank. |
| 224 | 904300 | 1 | At Eighty Tank: Metal water storage tank.[4] |
| 225 | 887298 | 1 | Metal water storage tank, capacity 20,060 liters (5300 gal) |
| 226 | 901327 | 1 | At Corral Tank: Dirt water storage tank. |
| 227 | 936293 | 1 | At San Juan Tank: Dirt water storage tank. |
| 228 | 920285 | 1 | At East Tank: Dirt water storage tank. |
| 229 | 952299 | 1 | At Eagle Tank: Concrete water storage tank. |
| 230 | 918343 | 1 | At Tiger Tank: Dirt water storage tank. |
| 231 | 947327 | 1 | At Coyote Tank: Metal water storage tank.[6] |
| 232 | 949360 | 1 | At Mesquite Tank: Dirt water storage tank. |
| 233 | 952375 | 1 | At Kirby Tank: Metal water storage tank, abandoned; corral, abandoned; building, ruin. |
| 234 | 992383 | 1 | At Eighteen Tank: Dirt water storage tank. |
| 235 | 919334 | 1 | Utility pole[5] |
| 236 | 976400 | 1 | Cattle watering trough |
| 237 | 948405 | 1 | At Kirby Pasture Tank: Concrete water storage tank, cattle watering trough. |
| 238 | 929382 | 1 | At Verde Tank: Metal water storage tank,[6] abandoned; three utility poles.[7] |
| 239 | 904376 | 1 | At Indio Tub: Cattle watering trough, metal. |
| 240 | 912376 | 1 | Two utility poles[5] |
| 241 | 864368 | 1 | At Joint Well: Concrete water storage tank, abandoned; metal water storage tank;[6] building, wooden, ruin; cattle feeding trough, wooden. |
| 242 | 896349 | 1 | At Square Tank: Metal water storage tank. |
| 243 | 865343 | 1 | At Guts Tub: Metal water storage tank; two utility poles.[5] |
| 244 | 816344 | 1 | At Eleven Tub: Cattle watering trough. |
| 245 | 819363 | 1 | At La T Tub: Metal water storage tank;[6] cattle watering trough. |
| 246 | 836365 | 1 | At La Palma Tub: Cattle watering trough. |
| 247 | 822381 | 1 | At Seven Tank: Metal water storage tank, capacity 18,925 liters (5000 gal); cattle watering trough. |
| 248 | 864368 to 911373 | 1 | Power line, length 4.7 km (2.9 mi), utility poles,[8] abandoned |
| 249 | 086414 | 1 | At Wallbridge Tank: Dirt water storage tank, abandoned; building, wooden, ruin. |
| 250 | 070435 | 1 | At Little Cement Tank: Concrete water storage tank, abandoned. |
| 251 | 061438 | 1 | At Big Cement Tank: Concrete water storage tank, abandoned; concrete cattle watering trough. |
| 252 | 087481 | 1 | At Red House Tank: Dirt water storage tank, abandoned; building, wooden, ruin. |
| 253 | 010485 | 1 | At New Tank: Dirt water storage tank, abandoned. |
| 254 | 975500 | 1 | At Coyote Tank: Dirt water storage tank, abandoned. |
| 255 | 967441 | 1 | At Lake Tank: Dirt water storage tank, abandoned. |
| 256 | 852449 | 1 | Metal water storage tank, abandoned; two cattle watering troughs, abandoned |
| 257 | 769432 | 1 | Building, ruin |
| 258 | 750348 | 1 | Windpump, ruin; well, abandoned; metal water storage tank, abandoned |
| 259 | 808364 | 1 | Windpump, height 8 m (25 ft); metal water storage tank; cattle watering trough |
| 260 | 808362 | 1 | Metal box tractor-trailer, 16 $m^2$ (170 $ft^2$), used as ranch house, located on mound of dirt, height 6 m (20 ft) |
| 261 | 816363 | 1 | Feed storage building, 56 $m^2$ (600 $ft^2$), concrete block |
| 262 | 784193 | 1 | Guard post building, 6 $m^2$ (64 $ft^2$), abandoned; security fenced area[2], 61 m x 24 m (200 ft x 80 ft), abandoned |
| 263 | 793326 | 1 | Metal water storage tank, abandoned |
| 264 | 932459 | 1 | At Meyer range individual tactical training course (inactive): Non-firing range, seven stations with 10 lanes per station; personnel shelter;[9] storage shed.[10] |
| 265 | 936458 | 1 | At Meyer range hand grenade assault course: Practice course, four courts with five throwing points per court; practice assault course, five lanes; personnel shelter;[9] storage shed.[10] |
| 266 | 932454 | 1 | At Meyer combat firing range (inactive): Three positions for defensive fire at linear, columnar, and oblique targets; earth berm, length 419 m (1375 ft), height 4 m (12 ft); storage shed;[10] personnel shelter;[9] latrine.[11] |
| 267 | 939455 | 1 | At Meyer range live hand grenade course: Ten bays; three earth berms, each 61 m (200 ft) long, height 4 m (12 ft); instructor's control bay; concrete block ammunition hut, 7 $m^2$ (80 $ft^2$), semi-permanent. |
| 268 | 931453 | 1 | At Meyer hedgerow firing range (inactive): 30 firing points, each 25 m (82 ft) long; observation tower.[12] |
| 269 | 929453 | 1 | Meyer target detection range 1, abandoned |
| 270 | 930451 | 1 | At Meyer range close combat course: Eight live-fire lanes; earth berm, length 267 m (875 ft), height 4 m (12 ft); observation tower;[12] storage shed;[10] latrine.[11] |
| 271 | 929450 | 1 | At Meyer range infiltration course (inactive): Four M-60 machine gun live-fire positions, accommodates 40 personnel per wave, one wave per two minutes; observation tower;[12] two personnel shelters;[9] latrine;[11] storage shed;[10] two earth berms;[13] one earth berm, length 91 m (300 ft), height 4 m (12 ft). |
| 272 | 916451 | 1 | At Meyer range chemical-biological-nuclear (CBN) training area and gas chambers (inactive): Two storage sheds;[10] personnel shelter;[9] gas chamber, 24 $m^2$ (263 $ft^2$), steel, 20-man capacity, temporary; gas chamber, 25 $m^2$ (266 $ft^2$), steel, 20-man capacity, temporary. |

# L. NON-URBAN CULTURE FEATURES (Continued)

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 273 | 686283 | 1 | At Water Well Number 14: Well pump, capacity 3747 liters per min (1,425,600 gal per day), mounted in building, 14 m² (151 ft²), concrete block, permanent, enclosed in security fence.[2] |
| 274 | 706283 | 1 | At Water Well Number 15: Well pump, capacity 3936 liters per min (1,497,600 gal per day), mounted in building, 14 m² (151 ft²), concrete block, permanent, enclosed in security fence.[2] |
| 275 | 702267 | 1 | At Water Well Number 16: Well pump, capacity 4012 liters per min (1,526,400 gal per day), mounted in building, 14 m² (151 ft²), concrete block, permanent, enclosed in security fence.[2] |
| 276 | 630757 | 2 | Parallel moving target: Length 1200 m (3937 ft), distance from firing line 900 m (2953 ft), speed of target 11 km/hr (7 mi/hr). |
| 277 | 714535 | 2 | At Hueco Camp Water Well: Well pump, capacity 946 liters per min (360,000 gal per day), mounted in building, 33 m² (360 ft²), steel, semi-permanent; steel water storage tank, capacity 75,700 liters (20,000 gal), elevated, height 15 m (50 ft), concrete base, semi-permanent; bunker, concrete, abandoned. |
| 278 | 996379 | 1 | Dirt water storage tank, abandoned |
| 279 | 682271 | 1 | Steel water storage tank, capacity 378,500 liters (100,000 gal), elevated, height 38 m (125 ft), concrete base, permanent |
| 280 | 686271 | 1 | Steel water storage tank, capacity 567,750 liters (150,000 gal), elevated, height 37 m (121 ft), concrete base, permanent |
| 281 | 673506 | 1-2 | At Wessly Well: Dirt water storage tank, abandoned; metal water storage tank, abandoned. |
| 282 | 927794 | 2-3 | At McNew South Tank: Two dirt water storage tanks, abandoned. |
| 283 | 742596 | 2 | Cattle watering trough, abandoned |
| 284 | 648613 | 2 | Two metal water storage tanks, abandoned |
| 285 | 653619 | 2 | At Scott Tank: Dirt water storage tank, abandoned. |
| 286 | 693664 | 2 | At Pit Tank: Dirt water storage tank, abandoned. |
| 287 | 873851 | 2 | At McNew Feeder Tank: Dirt water storage tank, abandoned; cattle feeding trough, abandoned. |
| 288 | 688694 | 2 | At Goodin Well: Metal water storage tank, ruin; dirt water storage tank, abandoned; windpump, ruin; equipment shed, adobe, ruin; ranch house, 84 m² (900 ft²), adobe, ruin; corral, abandoned. |
| 289 | 681736 | 2 | At Globe Well: Windpump, ruin; metal metal storage tank, ruin; metal water storage tank, abandoned; two corrals, abandoned; cattle watering trough, concrete, abandoned. |
| 290 | 675703 | 2 | At Goodin Tank: Dirt water storage tank, abandoned; corral, abandoned. |
| 291 | 666751 | 2 | Two metal water storage tanks, abandoned |
| 292 | 619751 | 2 | Corral, abandoned |
| 293 | 618752 | 2 | Cattle watering trough, abandoned |
| 294 | 592729 | 2 | Cattle watering trough, abandoned |
| 295 | 800726 | 2 | Two utility poles, height 1 m (4 ft) |
| 296 | 750730 | 2 | Utility pole[5] |
| 297 | 698735 | 2 | Utility pole[5] |
| 298 | 814659 | 2 | Four utility poles,[14] irregular spacing |
| 299 | 745567 | 2 | Utility pole[5] |
| 300 | 809589 | 2 | Utility pole[5] |
| 301 | 778526 | 2 | White Sands Missile Range (WSMR) facility, theodolite G-55,[15] mounted on tower |
| 302 | 607749 | 2 | At Globe Springs Ranch: Building, ruin. |
| 303 | 517744 | 2 | At Chimney Rock Tank: Dirt water storage tank, abandoned. |
| 304 | 544738 | 2 | Beasley-Issacs Cemetery, four gravesites, poor condition; building, ruin |
| 305 | 539733 | 2 | Windpump, ruin; cattle watering trough, ruin; two cattle feeding troughs, ruins |
| 306 | 581737 | 2 | At Beasley Ranch: House, ruin; two tool sheds, ruins. |
| 307 | 515741 | 2 | Dirt water storage tank, ruin |
| 308 | 904438 | 1 | Oxidation pond, 0.2 ha (0.4 acres), security fence[2] |
| 309 | 545735 | 2 | Cattle watering trough, abandoned; cattle feeding trough, ruin |
| 310 | 520713 | 2 | At Lower Tank: Dirt water storage tank, abandoned. |
| 311 | 537700 | 2 | At Dripping Springs Tank: Dirt water storage tank, abandoned. |
| 312 | 546783 | 2 | WSMR facility, Cloud Physics Field Site, building |
| 313 | 556697 | 2 | At Dripping Springs Ranch: Building, ruin; metal water storage tank, abandoned; corral, abandoned. |
| 314 | 529607 | 2 | At Dona Ana range observation post (OP) 4: Bunker;[16] steel pole, height 6 m (20 ft). |
| 315 | 527590 | 2 | At Dona Ana 41 range demolition area: Observation post (OP) 3, bunker.[16] |
| 316 | 550589 | 2 | Dona Ana range observation post (OP) 2, bunker [16] |
| 317 | 577569 | 2 | Oxidation pond, 1.6 ha (4 acres), enclosed by fence[1] |
| 318 | 918853 | 2-3 | Orogrande Fiesta microwave communications facility, 78 m² (844 ft²), concrete block, semi-permanent; Andrews P8-71G parabolic antenna, vertical, height 6 m (20 ft) |
| 319 | 888505 | 1-2 | At South McGregor Fiesta microwave and Mike Radar facility: Communications building, 79 m² (849 ft²), concrete block, semi-permanent; Andrews P4-71G parabolic antenna, horizontal, height 5 m (15 ft); radar antenna, 18 m (60 ft), steel dish. |
| 320 | 913490 | 1 | At Davis Dome: McGregor Range Camp Fiesta microwave communication facility, 468 m² (5040 ft²), concrete block, semi-permanent; five Andrews P8-71G parabolic antennas, one dual horizontal and vertical, two horizontal, two vertical, width 2 m (8 ft), height 3 m (10 ft) to 12 m (40 ft); one Andrews P4-71G parabolic antenna, horizontal, width 1 m (4 ft), height 6 m (19 ft); two steel towers, height 18 m and 23 m (60 ft and 75 ft). |
| 321 | 986805 | 2-3 | North McGregor Fiesta microwave communications facility, 79 m² (849 ft²), concrete block, semi-permanent; Collins 8PJ-79 parabolic antenna, horizontal, width 1 m (4 ft), height 5 m (15 ft) |
| 322 | 772201 | 1 | At Site Monitor (Air Defense Board test complex): 10 hectares (24 acres), fenced;[2] sentry station, 8 m² (82 ft²), concrete block, semi-permanent; shop building, 220 m² (2372 ft²), steel, temporary; communications center, 94 m² (1009 ft²), steel, temporary; storage shed, 23 m² (240 ft²), steel, temporary; applied instruction building, 179 m² (1928 ft²), steel, temporary; latrine, 24 m² (256 ft²), wood, temporary; six concrete slabs, abandoned; earth mound, height 3 m (10 ft); storage shed, 13 m² (144 ft²), steel, temporary; radar antenna tower, height 9 m (28 ft), steel, permanent; two electronic equipment facilities, 192 m² (2060 ft²), concrete block, permanent; radar test facility, 703 m² (7568 ft²), concrete block, permanent; standby generator shed, 17 m² (181 ft²), concrete block, semi-permanent, housing generator, 30 kw; well pump, capacity 83 liters per minute (31,680 gal per day), mounted in building, 19 m² (208 ft²), concrete block, permanent; water storage tank, capacity 113,550 liters (30,000 gal), steel, elevated, height 38 m (125 ft), concrete base, permanent; three dry wells. |
| 323 | 779208 | 1 | Jammer building, 30 m² (320 ft²), cinder block and steel, temporary |
| 324 | 784197 | 1 | At Sand Dunes Site (U S Drug Enforcement Agency facility): Quonset hut, 167 m² (1800 ft²); two antenna towers, height 38 m (125 ft). |
| 325 | 864376 to 849376 to 849367 and 855376 to 855365 | 1 | Power line, length 4.7 km (2.9 mi), abandoned; utility poles [5] |
| 326 | 602503 to 669777 | 1-2 | Telephone line 1: Length 32.3 km (20.1 mi), 26 to 36 bare hard-drawn (BHD) copper wires; utility poles.[7] Line originates at 639236 and enters the reservation at 602503. |
| 327 | 601509 to 801500 | 1-2 | Telephone line 1A: Length 21.2 km (13.2 mi), 30 wires, copper and copper-steel, 19 gage; utility poles.[7] |
| 328 | 684723 to 650727 | 2 | Telephone line 1B: Length 3.4 km (2.1 mi), eight wires, copper; utility poles.[14] |
| 329 | 650727 to 637760 | 2 | Telephone line 1B1: Length 3.6 km (2.2 mi), four wires, copper; utility poles.[14] |
| 330 | 650727 to 657685 | 2 | Telephone line 1B2: Length 4.2 km (2.6 mi), four wires, copper; utility poles.[14] |
| 331 | 685697 to 675695 | 2 | Telephone line 1C: Length 1 km (0.6 mi), two wires, copper; utility pole.[14] |
| 332 | 587574 to 578579 | 2 | Telephone line, connector: Length 1.7 km (1.1 mi), 10 wires, copper; utility poles.[14] |
| 333 | 578579 to 526528 | 2 | Telephone line 1L: Length 5.6 km (3.5 mi), 10 wires, copper; utility poles.[14] |
| 334 | 509535 to 576579 and 527543 to 535529 | | Power line (El Paso Electric): Length 8.8 km (5.5 mi), three number four wires, one number six wire, copper, 7.2/12.4 kv, three-phase; utility poles,[17] class 4. |
| 335 | 670267 to 975812 | 1-2-3 | Telephone line 2: Length 62 km (38.5 mi), 30 lines, copper-steel and copper, 19-gage; utility poles.[14] Line originates in the main cantonment area at 657241 and terminates in Orogrande Range Camp after leaving the reservation at 975812. |
| 336 | 926450 | 1 | Meyer target detection range 2 (inactive), non-firing |
| 337 | 924446 | 1 | Meyer target detection range 3 (inactive), non-firing |
| 338 | 922442 | 1 | At Meyer target detection range 4 (inactive): Range non-firing; latrine;[11] personnel shelter.[9] |
| 339 | 698271 to 706283 | 1 | Utility line, dual use: Length 4 km (2.5 mi); Telephone line 2B2, four wires, copper-steel; Power line, Four number four wires, copper, 13.2 kv, three phase; utility poles.[7] |
| 340 | 921437 | 1 | Meyer target detection range 5, non-firing |
| 341 | 628757 | 2 | Diagonal moving target, length 1225 m (4019 ft), distance from firing line 950 m (3117 ft) to 1200 m (3937 ft), speed of target 11 km/hr (7 mi/hr) |
| 342 | 801500 to 888499 | 1 | Telephone line 2C: Length 8.3 km (5.2 mi), 30 wires, copper and copper-steel, 19-gage; utility poles.[14] |
| 343 | 818495 to 818480 | 1 | Telephone line 2C1: Length 1.6 km (1 mi), four wires, copper; utility poles.[14] |
| 344 | 888497 to 887505 | 1-2 | Utility line, dual use: Length 0.8 km (0.5 mi); Telephone line 2C2, four wires, copper; Power line: four wires, 7.2/12.4 kv, three-phase; utility poles,[14] telephone and power,[18] alternating with telephone wires attached to every pole. |
| 345 | 972806 to 989804 | 2-3 | Utility line, dual use: Length 1.6 km (1 mi); Telephone line 2H, 10 wires, BHD copper; Power line, four wire. Single use utility poles[14] from 972806 to 982804, dual use utility poles from 982804 to 989803. |
| 346 | 988814 to 984814 to 987810 to 982804 | 2-3 | Utility line, dual use: Length 2.1 km (1.3 mi); Telephone line 2H1, single cable telephone; Power line, four wires, 7.2/12.4 kv, three-phase. |
| 347 | 972806 to 038995 | 2-3-4 | Utility line, dual use: Length 20 km (12.4 mi); Telephone line 2D, four to ten wires, BHD copper; Power line, four wire; utility poles.[14] Line is only telephone from 972806 to 997834 where it becomes dual use. |
| 348 | 036991 to 400832 | 3-4 | Telephone line 2D1: Length 43.4 km (27 mi), four wires, BHD copper; utility poles.[8] |
| 349 | 373916 to 448948 | 4 | Telephone line 2D2: Length 8.3 km (5.2 mi), four wires, BHD copper; utility poles.[5] |
| 350 | 997834 to 058833 | 2-3 | Telephone line 2D3: Length 6 km (3.7 mi), 10 wires, BHD copper; utility poles.[14] |
| 351 | 770199 to 779208 | 1 | Power line: Length 1.1 km (0.7 mi), four wires, copper, 7.2/12.4 kv, three phase; utility poles.[18] |
| 352 | 771202 to 913492 | 1 | Training telephone line SM-1: Length 26 km (16.2 mi), 10 wires, BHD copper; utility poles.[14] |
| 353 | 882440 to 923439 | 1 | Training telephone line, SM-1 Meyer range spur: Length 5.1 km (3.2 mi), 10 wires, BHD copper; utility poles.[5] |
| 354 | 119572 | 3 | At Castner East Tank: Dirt silt trap, dam length 67 m (220 ft), base width 9 m (30 ft), height 2 m (6 ft), abandoned. |
| 355 | 785686 | 2 | WSMR Facility, theodolite G-52.[15] |
| 356 | 719833 | 2 | WSMR Facility, theodolite G-107, telescope T-614 |
| 357 | 758847 | 2 | WSMR Facility, theodolite G-109,[15] telescope T-256 |
| 358 | 660610 | 2 | WSMR Facility, theodolite G-226, U.S. Army Air Defense Board (USARADBD) station CV-9[19] |
| 359 | 877683 | 2 | WSMR Facility, theodolite G-227[15] |
| 360 | 718803 | 2 | WSMR Facility, Velma Instrumentation Site |
| 361 | 710803 | 2 | WSMR Facility, target pole |
| 362 | 713798 | 2 | WSMR Facility, target pole |
| 363 | 919853 | 2-3 | At WSMR Facility, Elephant Mountain (T-3) Site: Microwave relay tower; communications building; radar R-115; electronics building. |
| 364 | 864854 | 2 | WSMR Facility, Ruth Surveillance Radar Site; radar R-360 |
| 365 | 738818 | 2 | At WSMR Facility, C Prime Site (also known as Cad Site): Radar R-394; telescope T-544; building. |
| 366 | 796830 | 2 | WSMR Facility, radar R-395 |
| 367 | 903711 | 2-3 | WSMR Facility, telescope T-417 |
| 368 | 732664 | 2 | WSMR Facility, antenna tower, telescoping, minimum height 7 m (22 ft) |
| 369 | 766853 | 2 | WSMR Facility, missile carriage structure |
| 370 | 711807 | 2 | At WSMR Facility, Long Range Precision Instrument Radar Site: Radars R-112, R-113, R-114; communications building; other buildings; communications tower. |
| 371 | 718795 | 2 | WSMR Facility, target pole |
| 372 | 723798 | 2 | WSMR Facility, target pole |
| 373 | 725803 | 2 | WSMR Facility, target pole |
| 374 | 723808 | 2 | WSMR Facility, target pole |
| 375 | 718811 | 2 | WSMR Facility, target pole |
| 376 | 712808 | 2 | WSMR Facility, target pole |
| 377 | 759844 | 2 | WSMR Facility; Water Instrumentation Site |
| 378 | 759852 | 2 | WSMR Facility, target pole |
| 379 | 765849 | 2 | WSMR Facility, target pole |
| 380 | 767844 | 2 | WSMR Facility, target pole |
| 381 | 765838 | 2 | WSMR Facility, target pole |
| 382 | 759836 | 2 | WSMR Facility, target pole |
| 383 | 955472 | 1 | At McGregor Range Launch Site 1: Nike missile launch pad, 3512 m² (37,800 ft²), asphalt surface; missile launch and storage facility, 469 m² (5053 ft²), underground, concrete, semi-permanent, with four above ground launchers; safe house;[20] standby generator building, 45 m² (480 ft²), concrete block, semi-permanent, housing 60 kw generator. |
| 384 | 954476 | 1 | At McGregor Range Launch Site 2: Missile launch pad;[21] safe house.[20] |
| 385 | 953479 | 1 | At McGregor Range Launch Site 3: Missile launch pad;[21] safe house.[20] |

# L. NON-URBAN CULTURE FEATURES (Continued)

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 386 | 951482 | 1 | At McGregor Range Launch Site 4: Ground fire for 20 mm Vulcan, 81 mm mortar (illumination rounds only), M-60 machine gun, .50 caliber machine gun; 18 point firing line; observation tower;[12] radio controlled aerial target (RCAT) and ballistic aerial target system (BATS) available; missile launch pad;[21] safe house.[20] |
| 387 | 949484 | 1 | At McGregor Range Launch Site 5: Missile launch pad;[21] safe house.[20] |
| 388 | 945488 | 1 | At McGregor Range Launch Site 6: Missile launch pad;[21] safe house.[20] |
| 389 | 943490 | 1 | At McGregor Range Launch Site 7: Missile launch pad;[21] safe house.[20] |
| 390 | 942494 | 1 | At McGregor Range Launch Site 8: Missile launch pad;[21] safe house.[20] |
| 391 | 941498 | 1 | At McGregor Range Launch Site 9: Missile launch pad;[21] safe house.[20] |
| 392 | 940501 | 1 | At McGregor Range Launch Site 10: Forward area weapons (FAW) firing range for Chaparral missile, Redeye missile, 20 mm Vulcan, 81 mm mortar (illumination rounds only), M-60 machine gun, .50 caliber machine gun; 18 Vulcan firing points, two Chaparral firing points, two Redeye firing points; aerial targets RCAT and BATS available; observation tower;[12] missile launch pad;[21] safe house.[20] |
| 393 | 939505 | 1-3 | At McGregor Range Launch Site 11: Missile Launch Pad;[21] Safe house.[20] |
| 394 | 938509 | 3 | At McGregor Range Launch Site 12: Missile Launch Pad;[21] Safe house.[20] |
| 395 | 939514 | 3 | At McGregor Range Launch Site 13 (Hawk missile firing site 8): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 396 | 938515 | 3 | At McGregor Range Launch Site (unnumbered) (Hawk missile firing site 7): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 397 | 938517 | 3 | At McGregor Range Launch Site 14 (Hawk missile firing site 6): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 398 | 937519 | 3 | At McGregor Range Launch Site (unnumbered) (Hawk missile firing site 5): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 399 | 937521 | 3 | At McGregor Range Launch Site 15 (Hawk missile firing site 4): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 400 | 937523 | 3 | At McGregor Range Launch Site (unnumbered) (Hawk missile firing site 3): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 401 | 936525 | 3 | At McGregor Range Launch Site 16 (Hawk missile firing site 2): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 402 | 935527 | 3 | At McGregor Range Launch Site 17 (Hawk missile firing site 1): Missile launch pad;[21] safe house;[20] two Hawk missile launch pads;[22] two radar parking pads;[23] vehicle parking pad;[24] generator parking pad;[25] aerial target drones Firebee/Towbee available. |
| 403 | 933531 | 3 | At McGregor Range Launch Site 18: Missile launch pad;[21] safe house.[20] |
| 404 | 932535 | 3 | At McGregor Range Launch Site 19: Missile launch pad;[21] safe house.[20] |
| 405 | 931537 | 3 | At McGregor Range Launch Site 20: Missile launch pad;[21] two Nike missile launchers; safe house.[20] |
| 406 | 927543 | 3 | At McGregor Range Launch Site 21: Missile launch pad;[21] two Nike missile launchers; safe house.[20] |
| 407 | 921546 | 3 | At McGregor Range Launch Site 22: Missile launch pad;[21] two Nike missile launchers; safe house.[20] |
| 408 | 915548 | 3 | At McGregor Range Launch Site 23 Missile launch pad;[21] two Nike missile launchers; safe house.[20] |
| 409 | 910550 | 3 | At McGregor Range Launch Site 24: Missile launch pad;[21] safe house.[20] |
| 410 | 905552 | 2-3 | At McGregor Range Launch Site 25: Missile launch pad;[21] safe house.[20] |
| 411 | 900554 | 2-3 | At McGregor Range Launch Site 26: Missile launch pad;[21] safe house.[20] |
| 412 | 919541 | 3 | Storage building, 60 m² (640 ft²), steel, temporary |
| 413 | 929464 | 1 | In-flight Control Points 1 and 2[26] |
| 414 | 927468 | 1 | In-flight Control Points 3 and 4[26] |
| 415 | 924471 | 1 | In-flight Control Point 5[27] |
| 416 | 921473 | 1 | In-flight Control Point 6[27] |
| 417 | 919475 | 1 | In-flight Control Point 7[27] |
| 418 | 918478 | 1 | In-flight Control Point 8[27] |
| 419 | 916484 | 1 | In-flight Control Points 9 and 10[26] |
| 420 | 914495 | 1 | In-flight Control Point 11[27] |
| 421 | 913502 | 1 | In-flight Control Points 12 and 13[26] |
| 422 | 911507 | 1-3 | In-flight Control Points 14 and 15;[26] tower, height 12 m (40 ft), metal |
| 423 | 909511 | 3 | In-flight Control Point 16[27] |
| 424 | 908513 | 3 | In-flight Control Point 17[28] |
| 425 | 904519 | 2-3 | In-flight Control Points 18 and 19[26] |
| 426 | 900525 | 2-3 | In-flight Control Point 20[27] |
| 427 | 898527 | 2-3 | In-flight Control Point 21[27] |
| 428 | 895531 | 2-3 | In-flight Control Point 22[27] |
| 429 | 891535 | 2 | In-flight Control Point 23[27] |
| 430 | 889542 | 2 | In-flight Control Point 24[27] |
| 431 | 883545 | 2 | In-flight Control Point 26[27]: used as an observation point for the aerial gunnery range; latrine[11] |
| 432 | 876546 | 2 | In-flight Control Point 26,[27] used as Cane Cholla aerial gunnery range landing area; two harmonization points; control tower;[28] two latrines;[11] range authorized for 2.75 inch aerial rockets, 7.62 mm machine gun, 20 mm and 40 mm cannon, M-72 light anti-tank weapon (LAW). |
| 433 | 893532 | 2 | At McGregor Range North In-flight Control Point: Observation tower;[29] general purpose operation building, 304 m² (3267 ft²), steel, temporary. |
| 434 | 909508 | 3 | At McGregor Range Hawk Control Point: Observation tower;[29] communications center building, 13 m² (140 ft²), concrete block, semi-permanent. |
| 435 | 913490 | 1 | Water pump house, 8 m² (89 ft²), concrete block, semi-permanent |
| 436 | 903498 | 1 | At McGregor Range Camp Hawk Guided Missile Supply Point: Guided missile magazine, 77 m² (831 ft²), concrete, earth covered, semi-permanent; guided missile magazine, 18 m² (192 ft²), concrete, earth covered, semi-permanent; guided missile maintenance facility, 251 m² (2706 ft²), concrete, earth covered, semi-permanent; surrounded by security fence.[2] |
| 437 | 904493 | 1 | At McGregor Range Camp ready missile storage area: Six earth revetments, each 30 m x 30 m (100 ft x 100 ft), with asphalt parking area 502 m² (5400 ft²), with front blast guards. |
| 438 | 901489 | 1 | At McGregor Range Camp missile assembly and test facility: Missile test building, 478 m² (5146 ft²), concrete block, semi-permanent; eight earth revetments, each 43 m x 30 m (140 ft x 100 ft), with asphalt parking area 929 m² (10,000 ft²), without front blast guards. |
| 439 | 898495 | 1 | Three missile fueling and warheading earth revetments, each 82 m x 64 m (270 ft x 210 ft), with asphalt parking area 1839 m² (19,800 ft²), drive-through |
| 440 | 899491 | 1 | At McGregor Range Camp missile warhead and fuel staging area: Guided missile magazine, 7 m² (80 ft²), steel frame, revetted, semi-permanent; two liquid propellant storage buildings, 5 m² (50 ft²), steel frame, one revetted, semi-permanent; fuse detonator magazine, 7 m² (80 ft²), steel frame, revetted, semi-permanent. |
| 441 | 896491 | 1 | At McGregor Range Camp missile warhead and fuel staging area: Guided missile magazine, 7 m² (80 ft²), steel frame, revetted, semi-permanent; missile launch pad, concrete and steel, semi-permanent; fuse detonator magazine, 7 m² (80 ft²), steel frame, revetted, semi-permanent; earth revetment 232 m² (2500 ft²). |
| 442 | 899492 | 1 | At McGregor Range Camp missile fueling and warheading area: Six earth revetments, each 49 m x 43 m (160 ft x 140 ft), with asphalt parking area 697 m² (7500 ft²), drive-through. |
| 443 | 895493 | 1 | McGregor Range Camp missile booster-joining earth revetment, 73 m x 70 m (240 ft x 230 ft), with asphalt parking area 3658 m² (39,375 ft²), drive-through |
| 444 | 898503 | 1-2-3 | At McGregor Range Camp ammunition dump: Four earth storage revetments; 101 m x 61 m (330 ft x 200 ft), area 4181 m² (45,000 ft²), 64 m x 55 m (210 ft x 180 ft), area 1533 m² (16,500 ft²), 67 m x 64 m (220 ft x 210 ft), area 2349 m² (26,250 ft²); and 73 m x 67 m (240 ft x 220 ft), area 2787 m² (30,000 ft²), all storage area surfaces asphalt. |
| 445 | 886487 | 1 | Imhoff septic tank drainage facility, 117,335 liters (31,000 gal) capacity, concrete block drying bed, semi-permanent, surrounded by security fence[2] |
| 446 | 886486 | 1 | Oxidation pond, 6.8 ha (16.9 acres), 50,498,967 liters (13,341,867 gal) capacity, surrounded by security fence[2] |
| 447 | 921433 | 1 | At Meyer target detection range 6 (inactive): Non-firing range; personnel shelter;[9] latrine.[11] |
| 448 | 922428 | 1 | Meyer target detection range 7 (inactive), non-firing |
| 449 | 923424 | 1 | Meyer target detection range 8 (inactive), non-firing |
| 450 | 926420 | 1 | Meyer target detection range 9 (inactive), non-firing |
| 451 | 928416 | 1 | At Meyer target detection range 9 (inactive): Non-firing range; latrine.[11] |
| 452 | 932415 | 1 | At Meyer night-firing rifle range (inactive): Earth berm.[30] |
| 453 | 930418 | 1 | At Meyer quick-kill range (inactive): BB gun and live-fire range of 50 points; personnel shelter, 297 m² (3200 ft²), wooden, temporary; observation tower.[12] |
| 454 | 928421 | 1 | At Meyer preliminary fire training rifle range 2 (inactive): 25 m (82 ft) range with 110 points, live-fire and battle-sight zero; personnel shelter;[9] storage shed;[10] earth berm.[13] |
| 455 | 926424 | 1 | At Meyer preliminary fire training rifle range 1 (inactive): 25 m (82 ft) range with 110 points, live-fire and battle-sight zero; two personnel shelters;[9] observation tower;[12] latrine;[11] storage shed;[10] earth berm.[13] |
| 456 | 925426 | 1 | At Meyer field-firing rifle range 4 (inactive): 300 m (984 ft) range with 35 points, live-fire with pop-up targets; earth berm;[13] observation tower;[12] storage shed;[10] personnel shelter.[9] |
| 457 | 924429 | 1 | At Meyer field firing rifle range 3 (inactive): 300 m (984 ft) range with 35 points, live-fire with pop-up targets; earth berm;[13] observation tower;[12] storage shed;[10] personnel shelter.[9] |
| 458 | 923433 | 1 | At Meyer field firing rifle range 2: 300 m (984 ft) range with 35 points, live-fire with pop-up targets; earth berm;[13] observation tower;[12] storage shed;[10] personnel shelter.[9] |
| 459 | 924436 | 1 | At Meyer field firing rifle range 1: 300 m (984 ft) range with 35 points, live-fire with pop-up targets; earth berm;[13] observation tower;[12] storage shed;[10] personnel shelter;[9] latrine.[11] |
| 460 | 922436 | 1 | At Meyer range operations area: Three storage warehouses;[31] operations building, 142 m² (1527 ft²), steel, temporary; water storage tank, 94,625 liters (25,000 gal) capacity, elevated, height 18.3 m (60 ft), steel concrete base, semi-permanent; storage shed.[10] |
| 461 | 924438 | 1 | At Meyer corrective rifle range 1 (inactive): 25-point firing line, live-fire; earth berm;[13] personnel shelter.[9] |
| 462 | 923435 | 1 | At Meyer corrective rifle range 2 (inactive): 25-point firing line, live-fire; earth berm.[13] |
| 463 | 924431 | 1 | At Meyer corrective rifle range 3 (inactive): 25-point firing line, live-fire; earth berm.[13] |
| 464 | 925428 | 1 | At Meyer corrective rifle range 4 (inactive): 25-point firing line, live-fire; earth berm;[13] storage shed;[10] latrine.[11] |
| 465 | 927446 | 1 | At Meyer record-firing range 1: 350 m (1148 ft) range with 16 points, live-fire; earth berm;[30] storage shed;[10] personnel shelter;[9] latrine;[11] storage shed, 36 m² (392 ft²); observation tower.[12] |
| 466 | 925441 | 1 | At Meyer record-firing rifle range 2 (inactive): 350 m (1148 ft) range with 16 points, live-fire; earth berm;[30] observation tower;[12] storage shed.[10] |
| 467 | 937413 | 1 | At Meyer combat fire concurrent training rifle course (inactive): 300 m (984 ft) range, live-fire; earth berm, length 323 m (1060 ft); earth berm, length 404 m (1325 ft). |
| 468 | 732354 | 1 | Oxidation ponding area, approximately 1.3 ha (3.2 acres) |
| 469 | 728354 | 1 | Oxidation ponding area, approximately 56.5 ha (139.6 acres) |
| 470 | 729348 | 1 | Oxidation ponding area, approximately 1 ha (2.5 acres) |
| 471 | 740350 | 1 | Oxidation ponding area, approximately 43 ha (106.3 acres) |
| 472 | 988814 | 2-3 | At Firebee-Towbee launching facility: Target drone staging area, 639 m² (6875 ft²); flagpole;[32] alinement building, 112 m² (1200 ft²), steel, temporary; launch control center, 15 m² (160 ft²), steel, temporary; two launching pads, each 348 m² (3750 ft²), concrete, temporary; two storage sheds.[10] |
| 473 | 988802 | 2-3 | At radio control facility: Latrine;[11] radio station building, 11 m² (120 ft²), concrete block, semi-permanent; radio transmitter building, 14 m² (151 ft²), concrete block, semi-permanent. |
| 474 | 991799 | 2-3 | At RCAT launching facility: Repair shop, 292 m² (3147 ft²), concrete block, semi-permanent; two jet-assisted take-off (JATO) pads, each 7 m² (79 ft²), concrete; water tank, 75,700 liters (20,000 gal) capacity, elevated, height 12 m (40 ft), steel with concrete base, semi-permanent; water pump house, 3 m² (28 ft²), steel, semi-permanent; latrine;[11] five Redeye and RCAT launching pads. |
| 475 | 920855 | 2-3 | Water storage tank, 567,750 liters (150,000 gal) capacity, steel, concrete base, semi-permanent, connected to Orogrande range camp system by 20.3 cm (8 in) line; water storage tank, 189,250 liters (50,000 gal) capacity, steel, concrete base, semi-permanent, connected to Orogrande range camp system by 15.2 (6 in) diameter line; water storage tank, steel, concrete base, connected to Orogrande range camp system by 10.2 cm (4 in) diameter line, abandoned. |
| 476 | 773846 | 2 | At WSMR facility: Five metal storage tanks, height approximately 6 m (20 ft). |
| 477 | 848846 | 2 | Tower, radio, height 12 m (40 ft) |
| 478 | 848840 | 2 | At WSMR site: Theodolite.[20] |
| 479 | 848842 | 2 | At WSMR site: Tower, height 18 m (60 ft), steel. |
| 480 | 787834 | 2 | At WSMR Site: Tower, radio, height 18 m (60 ft), steel. |
| 481 | 788831 | 2 | At WSMR site: Theodolite.[20] |

# L. NON-URBAN CULTURE FEATURES (Continued)

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 482 | 598507 | 2 | USARADBD Theodolite Station CV-2[19] |
| 483 | 618594 | 2 | USARADBD Theodolite Station CV-1[19] |
| 484 | 636598 | 2 | USARADBD Theodolite Station CV-6[19] |
| 485 | 599572 | 2 | USARADBD Theodolite Station CV-7[19] |
| 486 | 612577 | 2 | USARADBD Theodolite Station CV-5[19] |
| 487 | 652601 | 2 | USARADBD Theodolite Station CV-8[19] |
| 488 | 682524 | 2 | USARADBD Theodolite Station CV-3[19] |
| 489 | 058833 | 3 | At North McGregor Range: Chaparral missile firing line, 12 firing points; Redeye missile firing line, four firing points; Chaparral, Redeye, Vulcan, and 81 mm mortar (illumination rounds only) authorized; two storage huts; USARADBD building, 223 m² (2400 ft²), metal, semi-permanent; latrine; two observation towers.[12] |
| 490 | 535529 | 2 | Telephone microwave relay tower: Building, cinder block; antenna, height 6 m (20 ft); security fence.[2] |
| 491 | 865513 | 2 | At WSMR Facility: Two Pershing launch facilities; observation shelters. |
| 492 | 858509 | 2 | WSMR Pershing missile firing support facility |
| 493 | 861439 | 1 | At Newman Ranch: Two metal water storage tanks, abandoned; corral, abandoned; barn, ruin; house, ruin. |
| 494 | 555655 | 2 | At Dona Ana 40 tank range firing area: Tank tables VII and VIII, nine combination moving and stationary targets; weapons authorized are 105 mm main gun, 152 mm main gun, Shillelagh missile, .50 caliber machine gun, 7.62 mm machine gun; cannot be used concurrently with Dona Ana 47 or 50; observation tower;[12] flagpole.[32] |
| 495 | 538653 | 2 | At Dona Ana 40 tank range cantonment area: Building, 93 m² (1000 ft²), metal, temporary; storage shed;[10] latrine;[33] pop-up electrical targets. |
| 496 | 545555 | 2 | At Dona Ana 42 artillery range: 38-point indirect live-fire area; authorized weapons 105 mm and 155 mm howitzer, 8-inch gun-howitzer, 4.2 inch mortar, and 81 mm mortar; cannot be used concurrently with Dona Ana 40, and OP1 and OP2 must be evacuated; flagpole.[32] |
| 497 | 584580 | 2 | At Dona Ana 43 tank range: Tank tables I and II, live-fire area; weapon authorized is tank-mounted M-60 machine gun; flagpole;[32] latrine;[33] control tower;[29] storage shed, 60 m² (640 ft²), steel, semi-permanent; five earth berms;[34] flagpole.[32] |
| 498 | 586582 | 2 | At Dona Ana 44 tank range: Tank table III, live-fire area; weapon authorized is tank-mounted M-60 machine gun; moving target, 206 m (675 ft) traverse; flagpole;[32] control tower;[29] latrine;[33] storage shed, 4 m² (43 ft²), steel, temporary; two earth berms;[34] earth berm, length 300 m (984 ft), height 4 m (12 ft). |
| 499 | 588578 | 2 | At Dona Ana 45 rifle range: 600 m (1969 ft) range with 40 points; live-fire area; flagpole.[32] |
| 500 | 601589 | 2 | At Dona Ana 46 automatic weapons and guided missile range: 10-point test range for automatic weapons, small guided air defense missiles, and others as authorized; cannot be operated concurrently with Dona Ana 43, 44, and 45; flagpole;[32] building, 18 m² (196 ft²), cinder block, semi-permanent. |
| 501 | 610595 | 2 | At Dona Ana 47 air defense artillery automatic weapons range: Four distinct areas, target drone launch area, 50-point live-fire area, live-fire move-shoot-move area, live-fire small arms area; RCAT and BATS target drones available; cannot be operated concurrently with Dona Ana 40 and 49; weapons authorized are 20 mm and 40 mm automatic cannon, machine guns, 81 mm mortar, 4.2 inch mortar; flagpole;[32] observation tower, height 31 m (100 ft), steel, abandoned. |
| 502 | 658642 | 2 | At Dona Ana 48 artillery range: 14-point live-fire area; authorized weapons are 105 mm and 155 mm howitzer, 8-inch gun-howitzer, tank cannon; flagpole.[32] |
| 503 | 657685 | 2 | At Dona Ana 49 tank range: Tank table VI, combination moving and stationary live-fire targets; authorized weapons are Vulcan, Duster, and machine guns; cannot be used concurrently with Dona Ana 47 or 50; flagpole;[32] building, 74 m² (800 ft²), metal, temporary; latrine.[33] |
| 504 | 656712 | 2 | At Dona Ana 50 air defense artillery automatic weapons range: Live ground and aerial firing range with 63 points, authorized weapons are 20 mm and 40 mm automatic cannon and machine guns; extends from 651725 to 662698; cannot be operated concurrently with Dona Ana 40 or 49; aerial target drones RCAT, Firebee, and BATS available; six control towers;[30] six latrines;[35] six personnel shelters;[36] flagpole;[32] six ammunition loading docks.[37] |
| 505 | 650727 | 2 | At Dona Ana 51 tank range: Tank table IV, stationary target live-fire, authorized weapons are 105 mm howitzer, 152 mm gun-launcher, Shillelagh missile; observation tower;[29] latrine;[33] personnel shelter;[36] flagpole;[32] ammunition loading dock.[37] |
| 506 | 644744 | 2 | At Dona Ana 52 machine gun range: M-60 machine gun transition and zero live-fire area; 5 points with pop-up, E-type silhouette, and panel targets; authorized weapons are .50 caliber ground-mount machine gun and M-60 machine gun; observation tower;[28] latrine;[33] personnel shelter;[36] flagpole;[32] ammunition loading dock.[37] |
| 507 | 642749 | 2 | At Dona Ana 53 rocket range: 12-position M-79 grenade launcher, 15-point 3.5 in. rocket launcher; live-fire area; stationary targets; authorized weapons are 66 mm LAW, M-79 grenade launcher, 3.5 in. rocket launcher; observation tower;[12] latrine;[33] personnel shelter;[36] flagpole;[32] ammunition loading dock.[37] |
| 508 | 637760 | 2 | At Dona Ana 54 air defense and anti-mechanized range: Tank table V, high explosive ammunition and aerial firing not allowed; authorized weapons are tank cannon, Vulcan, and machine guns; observation tower;[29] latrine;[33] personnel shelter;[36] flagpole;[32] ammunition loading dock.[37] |
| 509 | 549596 | 2 | Automobile bodies used as targets scattered on range |
| 510 | 565588 | 2 | Dona Ana range observation post (OP) 1, two concrete bunkers[16] |
| 511 | 578582 | 2 | Storage shed, 13 m² (144 ft²), wood, temporary; earth berm, length 85 m (280 ft), height 4 m (12 ft) |
| 512 | 282885 | 4 | Dirt water storage tank, abandoned |
| 513 | 283884 | 4 | Dirt water storage tank, abandoned |
| 514 | 652673 | 2 | Dona Ana 48 range observation post (OP) 100, bunker[16] |
| 515 | 650659 | 2 | Dona Ana 48 range observation post (OP) 101, bunker[16] |
| 516 | 794357 | 1 | At Newman VORTAC beacon: Tower; height 8 m (25 ft); security fence;[2] Federal Aviation Administration (FAA) building, concrete block. |
| 517 | 685271 | 1 | Radio transmitter building, 229 m² (2467 ft²), concrete block, semi-permanent |
| 518 | 678271 | 1 | Landfill and salvage area, 677,241 m² (7,290,000 ft²), surrounded by security fence[2] |
| 519 | 692271 | 1 | At Hawk missile radar park: 14 radar test sites, each 8 m² (90 ft²), concrete; storage shed, 62 m² (672 ft²), steel, temporary; laboratory and maintenance building, 592 m² (6367 ft²), concrete block, semi-permanent; laboratory and maintenance building, 699 m² (7520 ft²), concrete block, semi-permanent; six laboratory and maintenance buildings;[38] storage building, 545 m² (5867 ft²), concrete block, permanent; surrounded by security fence.[2] |
| 520 | 685280 | 1 | Landfill and rubble dump area, 443,690 m² (4,776,000 ft²), surrounded by security fence[2] |
| 521 | 687271 to 686283 | 1 | Utility line, dual use: Length 1.3 km (0.8 mi); Telephone line 2B, four wires, copper-steel; Power line, four number four wires, copper, 13.2 kv, three-phase; utility poles.[7] |
| 522 | 920854 | 2-3 | Concrete water storage tank, abandoned |
| 523 | 757189 to 737385 and 558504 to 509579 and 781500 to 923854 | 1-2-3 | Power line (El Paso Electric): Length 66.5 km (41.3 mi), three wires, 556.5 thousand circular mils (MCM) aluminum-steel cable reinforced (ASCR) number two, two static ground wires, 0.95 cm (0.375 in) ASCR, 115 kv, three-phase; utility poles,[17] class three. Line leaves reservation boundary at 737386 and similar lines reenter at 558504 and 781500. |
| 524 | 767190 to 770199 | 1 | Power line (El Paso Electric): Length 1.1 km (0.7 mi), three number four wires, one number six copper, 7.2/12.4 kv, three-phase; utility poles.[7] |
| 525 | 912850 | 2-3 | Television relay tower: Building, 16 m² (168 ft²), concrete block; antenna tower, height 15 m (50 ft); security fence.[2] |
| 526 | 917862 to 912850 and 912854 to 919853 | 2-3 | Power line (El Paso Electric): Length 1.3 km (0.8 mi), three wires number four open copper, 7.2/12.4 kv, three-phase; one wire number six open copper, neutral; utility poles,[39] class three. |
| 527 | 817480 to 888497 | 1 | Power line FB-KN: Length 8.6 km (5.3 mi), two wires number one-ought, 13.2 kv/13.8 kv, single-phase; utility poles.[18] |
| 528 | 743395 to 888497 | 1 | Power line (El Paso Electric Co.): Length 18 km (11.2 mi), four wires ASCR, 69 kv, three phase; utility poles,[40] class three. |
| 529 | 913492 to 931455 | 1 | Utility line, dual purpose: Length 4.3 km (2.7 mi); Telephone line, four BHD copper; Power line, three wires number three ASCR, 13.8 kv, three phase; one wire number three-ought ASCR, neutral; utility poles.[18] |
| 530 | 913492 to 938507 to 955472 to 899553 | 1-2-3 | Power cable: Length 9.7 km (6.0 mi), range distribution, buried (underground) 0.6 m (2 ft), three wires number four-ought ASCR, 13.8 kv, three phase, one wire number four-ought, neutral. |
| 531 | 939456 to 932414 and 922438 to 909438 and 916438 to 917451 | 1 | Power cable: Length 5.1 km (3.2 mi), range distribution, buried (underground) 0.6 m (2 ft), two wires number four ASCR, 7.2 kv, single phase. |
| 532 | 241017 | 4 | House, 56 m² (600 ft²), wooden, abandoned |
| 533 | 801577 | 2 | Observation tower, 6 m² (64 ft²), height 5 m (15 ft), wooden, abandoned |
| 534 | 662525 | 2 | Building, 13 m² (144 ft²), concrete, abandoned; utility pole, height 20 m (65 ft), wooden, creosote treated |
| 535 | 629781 to 658685 and 651727 to 675695 and 668719 to 663716 | 2 | Power line FB-KO: Length 15.4 km (9.6 mi), four number four ASCR wires, 7.2 kv/12.5 kv, three phase; utility poles,[18] class four. |
| 536 | 690550 to 702550 to 702540 to 690540 to origin | 2 | Fence,[1] length 4.3 km (2.7 mi) |
| 537 | 663716 | 2 | Building, 16 m² (168 ft²), metal |
| 538 | 781852 | 2 | At WSMR facility: Power substation, surrounded by security fence.[2] |
| 539 | 676695 | 2 | Target drone storage building, 279 m² (3000 ft²), metal, semi-permanent; two shop buildings, 139 m² (1500 ft²), metal, semi-permanent; three storage buildings;[10] surrounded by security fence [2] |
| 540 | 682271 to 687271 | 1 | Power line (El Paso Electric): Length 0.5 km (0.3 mi), four number four wires, copper, 13.2 kv, three phase; utility poles.[7] |
| 541 | 920506 to 925508 to 927504 to 922502 to origin | 1-3 | Fence,[1] length 1.7 km (1.1 mi) |
| 542 | 931498 to 934499 to 935495 to 932494 to origin | 1 | Fence,[1] length 1.4 km (0.9 mi) |
| 543 | 916439 | 1 | At basic training course area: Four barracks buildings, 93 m² (1000 ft²), metal, temporary; three storage sheds,[10] portable; two storage sheds, each 6 m² (64 ft²), portable. |
| 544 | 923439 | 1 | Meyer range monument, bronze and granite, height 1 m (3 ft) |
| 545 | 887520 | 2 | At WSMR facility, frequency control site: Tower, radio, height 24 m (80 ft), steel; building, 74 m² (800 ft²), steel. |
| 546 | 040907 | 4 | Turquoise cattle watering trough, abandoned |
| 547 | 035895 | 4 | Shipping Pasture cattle watering trough, abandoned |
| 548 | [1]87730 | 3 | At New Wells: Samson windpump, blade diameter 5 m (16 ft), ruin; two wells, depth 64 m (210 ft), abandoned; Challenge windpump, blade diameter 3 m (10 ft), ruin; metal water storage tank, abandoned; cattle watering trough, metal, abandoned. |
| 549 | 174682 | 3 | At Lucky Tank: Dirt water storage tank, dam length 160 m (525 ft), base width 14 m (45 ft), height 2 m (8 ft), abandoned. |
| 550 | 184058 | 4 | Elevated 15.2 cm (6 in) water line, height approximately 5 m (15 ft), length 221 m (725 ft), metal, mounted on wooden frame trestle, spanning primary watercourse originating from Culp Canyon |
| 551 | 140700 | 3 | At Lower Big Mack Tank: Dirt water storage tank, dam length 288 m (945 ft), base width 18 m (60 ft), height 3 m (10 ft), with three diversion dams and spillway, abandoned. |
| 552 | 142700 | 3 | At Upper Big Mack Tank: Dirt water storage tank, dam length 244 m (800 ft), base width 12 m (40 ft), height 3 m (10 ft), with two spillways, abandoned; seven corrals, abandoned; building, 27 m² (288 ft²), wooden, abandoned; cistern, concrete, abandoned; feed shed, 26 m² (280 ft²), wooden, ruin; privy, 2 m² (25 ft²), wooden, ruin; cattle watering trough, metal, abandoned. |
| 553 | 539555 to 510664 | 2 | Telephone line 1L1: Length 9.6 km (6 mi), six wires, copper; utility poles.[5] |
| 554 | 576579 to 538653 | 2 | Power line FB-LN: Length 14.3 km (8.9 mi), four number six wires ASCR, 2.4 kv, single phase; utility poles,[18] class four. |
| 555 | 782843 | 2 | Switch and metering power substation, El Paso Electric; security fence[2] |
| 556 | 848855 to 705799 | 2 | Power line (El Paso Electric): Length 16.5 km (10.3 mi), three wires 336.4 MCM ASCR number two, two static ground wires, 0.95 cm (0.375 in), 7.2/12.4 kv, three phase; utility poles,[17] class three. |
| 557 | 848847 to 848840 | 2 | Power line: Length 0.9 km (0.6 mi), four wires number four ASCR, 7.2/12.4 kv, three phase; utility poles.[7] |
| 558 | 788845 to 788831 | 2 | Power line: Length 1.3 km (0.8 mi), four wires number four ASCR, 7.2/12.4 kv, three phase; utility poles.[7] |
| 559 | 775853 to 773845 | 2 | Power line: Length 0.9 km (0.6 mi), four wires number four ASCR, 7.2/12.4 kv, three phase; utility poles.[8] |
| 560 | 754853 to 816854 | 2 | Power line: Length 6.3 km (3.9 mi), four wires number four-ought copper, 7.2/12.4 kv, three-phase; utility poles.[8] |
| 561 | 991800 to 986810 | 2-3 | Telephone line: Length 0.6 km (0.4 mi), range distribution, single cable, copper; utility poles.[18] |
| 562 | 981819 to 991800 | 2-3 | Power line: Length 0.5 km (0.3 mi), four copper wires number four, 7.2 kv/12.4 kv, three-phase; utility poles,[39] class four, dual-use from 984815 to 986810, carrying telephone line described in item 346. |
| 563 | 982818 to 058838 | 2-3 | Power line: Length 8.6 km (5.3 mi), four wires ASCR number four, 7.2 kv/12.4 kv, three phase; utility poles,[39] class four. |
| 564 | 038995 | 4 | Guard Post Number One; metal Butler building, 13 m² (140 ft²), portable |
| 565 | 680285 to 704284 and 704286 to 704276 | 1 | Telephone line: length 3.4 km (2.1 mi), abandoned; utility poles.[7] |
| 566 | 671267 to 698315 | 1 | Power line (El Paso Electric): Length 5.5 km (3.4 mi), three wires 556.5 MCM ASCR number two, two static ground wires, 0.95 cm (0.375 in), 115 kv, three-phase; utility poles,[17] class three. |
| 567 | 770199 to 784197 | 1 | Telephone line: Length 1.4 km (0.9 mi), four wires, BHD copper; utility poles;[5] abandoned. |
| 568 | 784193 to 784197 | 1 | Power line (El Paso Electric): Length 0.5 km (0.3 mi), three number four wires, one number six copper, 7.2/12.4 kv, three phase; utility poles.[7] |
| 569 | 723360 to 794357 | 1 | Utility line, dual-use: Length 7.2 km (4.5 mi); Telephone line, single cable; Power line (El Paso Electric), four wire, 7.2/12.4 kv, three phase; utility poles.[7] |
| 570 | 932414 to 939456 | 1 | Telephone line: length 5.7 km (3.5 mi), two wires, copper; utility poles.[7] |

# L. NON-URBAN CULTURE FEATURES (Continued)

| MAP NUMBER | GRID REFERENCE | MAP SHEET | DESCRIPTION |
|---|---|---|---|
| 571 | 911499 to 876546 and 887520 to 895527 | 1-2-3 | Power line: Length 7.5 km (4.7 mi), range distribution; three wires number three-ought ASCR, 13.8 kv, three-phase; one wire number three-ought ASCR, neutral; utility poles.[18] |
| 572 | 887505 to 887520 | 1-2 | Telephone line: Length 1.4 km (0.9 mi), two cables; utility poles.[5] |
| 573 | 888497 to 911499 | 1 | Utility line, dual use: Length 2.3 km (1.4 mi); Telephone line, 10 wires, BHD copper; Power line, three wires number three-ought ASCR, 13.8 kv, three-phase, one wire number three-ought ASCR, neutral; power poles[7] alternating with telephone poles,[5] with telephone lines connected to every pole. |
| 574 | 814318 to 861284 | 1 | Power line (El Pase Electric): Length 6.4 km (4.0 mi), four wires, copper, 7.2 kv, three phase; utility poles.[14] |
| 575 | 905541 to 908539 | 3 | Power line: length 0.5 km (0.3 mi), abandoned; utility poles.[14] |
| 576 | 532526 | 2 | Moving target, track bed, along bottom of hill, length approximately 1200 m (3937 ft), abandoned; building, 9 m² (100 ft²), stone, ruin |
| 577 | 782852 to 782843 | 2 | Power line: Length 0.9 km (0.6 mi), four wires number four ASCR, 7.2/12.4 kv, three phase; utility poles.[7] |
| 578 | 783200 | 1 | Radio communications antenna field array, approximately 40 antennas of various heights with tallest 21 m (70 ft), all within 200 m (656 ft) radius |
| 579 | 908491 | 1 | McGregor airstrip: Length 1219 m (4000 ft), width 11 m (35 ft), elevation above sea level 1250 m (4100 ft), azimuth 57°-237°, asphalt, abandoned; utility poles[14] at southeastern end and northwestern side; helicopter landing zone (HLZ) at northeastern end. |
| 580 | 928839 | 2-3 | Orogrande range camp airstrip: Length 1200 m (3937 ft), width unknown, elevation above sea level 1280 m (4200 ft), azimuth 35°-215°, dirt surface badly deteriorated, abandoned. |

1 Fence: Height 1 m (4 ft), three, four, or five-strand barbed wire, steel or juniper posts.

2 Fence: Height 2 m (7 ft), chain-link security, steel posts.

3 Guided missile magazine: 228 m² (2455 ft²), concrete, earth-covered, semi-permanent.

4 Water storage tank, metal: Capacity 56,775 liters (15,000 gal), railroad tank car body dismounted.

5 Utility pole: Height 8 m (25 ft), wooden, creosote treated.

6 Water storage tank, metal: Capacity 45,420 liters (12,000 gal), railroad tank car body dismounted.

7 Utility pole: Height 11 m (35 ft), wooden, creosote treated.

8 Utility pole: Height 6 m (20 ft), wooden, cresote treated.

9 Personnel shelter: 149 m² (1600 ft²), sun shade, steel, temporary.

10 Storage shed: 45 m² (480 ft²), steel, temporary.

11 Latrine: 7 m² (72 ft²), wooden, 4-man, temporary.

12 Observation tower: 13 m² (144 ft²), height 6 m (20 ft), wooden, temporary.

13 Earth berm: Length 189 m (620 ft), height 4 m (12 ft).

14 Utility pole: Height 9 m (30 ft), wooden, creosote treated.

15 WSMR theodolite: Height 9 m (30 ft).

16 Artillery observation bunker: 22 m² (240 ft²), 3 m (9 ft) deep, concrete.

17 Utility pole: Height 24 m (80 ft), wooden, double, with cross bar, creosote treated.

18 Utility pole: Height 12 m (40 ft), wooden, creosote treated.

19 USARADBD theodolite station: Building, 15 m² (160 ft²), cinder block, semi-permanent, height 6 m (20 ft) to top of antenna.

20 Safe house: 22 m² (239 ft²) for personnel during missile firing, underground, concrete, semi-permanent.

21 Missile launch pad: 7358 m² (79,200 ft²), asphalt surfaced.

22 Hawk missile launch pad: 1003 m² (10,800 ft²), asphalt surfaced.

23 Radar parking pad: 149 m² (1600 ft²), asphalt surfaced.

24 Vehicle parking pad: 502 m² (5400 ft²), asphalt surfaced.

25 Generator parking pad: 149 m² (1600 ft²), asphalt surfaced.

26 In-flight control point: 12,718 m² (136,900 ft²), double site, asphalt surfaced.

27 In-flight control point: 6359 m² (68,450 ft²), single site, asphalt surfaced.

28 Observation tower: 6 m² (64 ft²), height 9 m (30 ft), wooden, temporary.

29 Observation tower: 6 m² (64 ft²), height 12 m (40 ft), steel, semi-permanent.

30 Earth berm: Length 366 m (1200 ft), height 4 m (12 ft).

31 Storage warehouse: 155 m² (1671 ft²), steel, temporary.

32 Range warning flagpole (utility pole): Height 6 m (20 ft) to 11 m (35 ft), wooden, creosote treated.

33 Latrine: 8 m² (86 ft²), steel, temporary.

34 Earth berm: Length 76 m (250 ft), height 4 m (12 ft).

35 Latrine: 17 m² (180 ft²), wooden, temporary.

36 Personnel shelter: 74 m² (800 ft²), steel, temporary.

37 Ammunition loading dock: 50 m² (540 ft²), height 2 m (5 ft), concrete.

38 Laboratory and maintenance building: 274 m² (2947 ft²), concrete block, semi-permanent.

39 Utility pole: Height 14 m (45 ft), wooden, creosote treated.

40 Utility pole: Height 18 m (60 ft), wooden, creosote treated.

JOINS MAP 2

JOINS MAP 3

JOINS INSET

JOINS MAP 3

JOINS MAP 1

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS
ESCONDIDO CANYON
ROGERS RUINS
ORGAN PEAK
WHITE SANDS
ORO GRANDE
PENDEJO WASH
PRATHER RANCH
(Pictomap - Series V7810)
LA MESA
NEWMAN
DESERT
BASSETT LAKE
FORT BLISS
HUECO TANKS
Series V781
Series V782

MAP 1
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## NON-URBAN CULTURE FEATURES

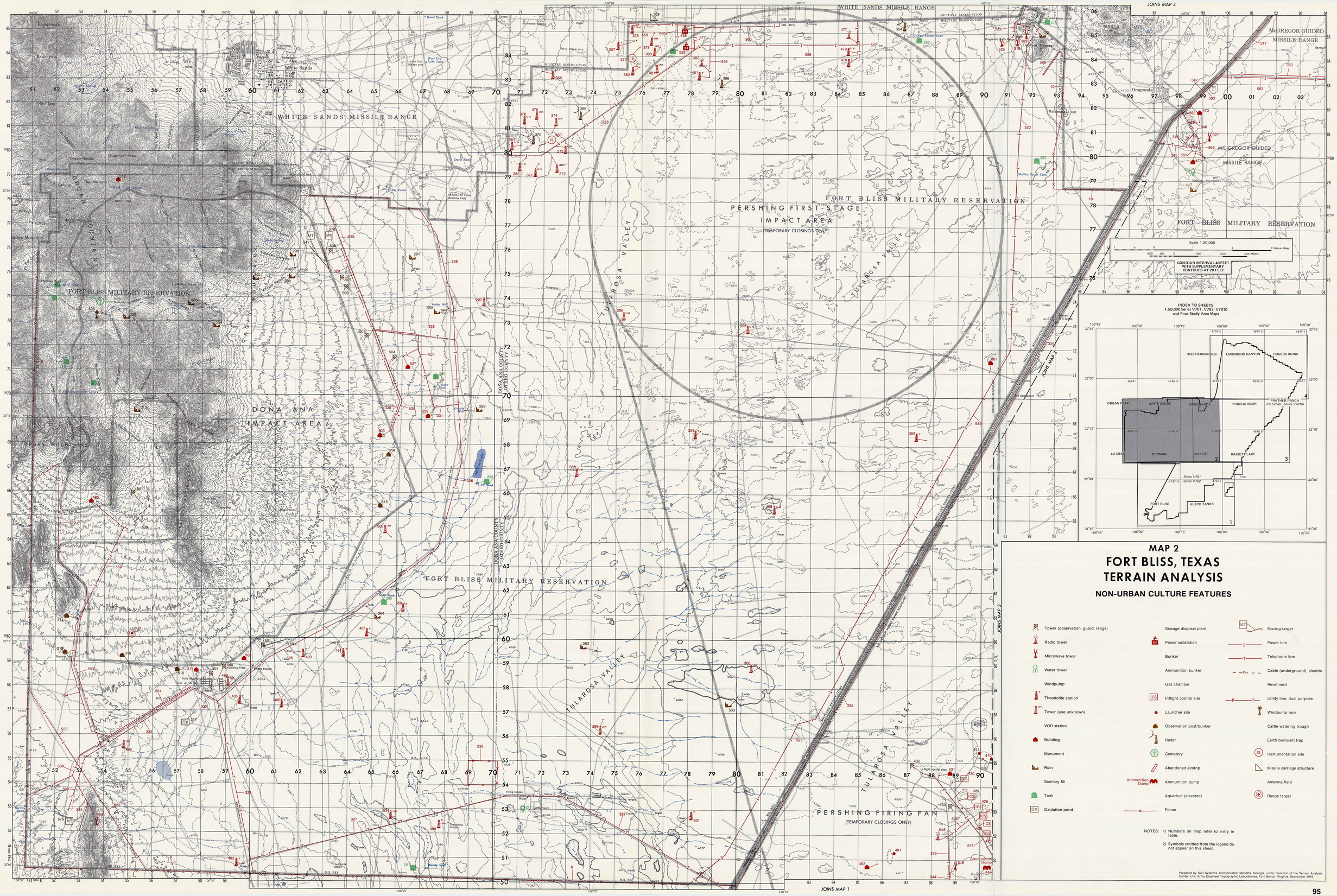
- Tower (observation, guard, range)
- Radio tower
- Microwave tower
- Water tower
- Windpump
- Theodolite station
- Tower (use unknown)
- VOR station
- Building
- Monument
- Ruin
- SF Sanitary fill
- Tank
- OX Oxidation pond
- SD Sewage disposal plant
- Power substation
- Bunker
- Ammunition bunker
- Gas chamber
- ICS Inflight control site
- Launcher site
- Observation post/bunker
- Radar
- Cemetery
- Abandoned airstrip
- Ammunition Dump Ammunition dump
- Aqueduct (elevated)
- Fence
- Moving target
- Power line
- Telephone line
- Cable (underground), electric
- Revetment
- Utility line, dual purpose
- Windpump ruin
- Cattle watering trough
- Earth berm/silt trap
- Instrumentation site
- Missile carriage structure
- AF Antenna field
- Range target

Scale 1:50,000
1000 500 0 1000 2000 3000 Meters
0 1 2 3 Statute Miles

CONTOUR INTERVAL
Sheets 4747 I, 4747 IV, 4748 II, 4748 III
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4848 III
50 FEET

NOTES: 1) Numbers on map refer to entry in table.
2) Symbols omitted from the legend do not appear on this sheet.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.




# MAP 2
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## NON-URBAN CULTURE FEATURES

- Tower (observation, guard, range)
- Radio tower
- Microwave tower
- Water tower
- Windpump
- Theodolite station
- Tower (use unknown)
- VOR station
- Building
- Monument
- Ruin
- Sanitary fill
- Tank
- Oxidation pond
- Sewage disposal plant
- Power substation
- Bunker
- Ammunition bunker
- Gas chamber
- Inflight control site
- Launcher site
- Observation post/bunker
- Radar
- Cemetery
- Abandoned airstrip
- Ammunition dump
- Aqueduct (elevated)
- Fence
- Moving target
- Power line
- Telephone line
- Cable (underground), electric
- Revetment
- Utility line, dual purpose
- Windpump ruin
- Cattle watering trough
- Earth berm/silt trap
- Instrumentation site
- Missile carriage structure
- Antenna field
- Range target

NOTES: 1) Numbers on map refer to entry in table.

2) Symbols omitted from the legend do not appear on this sheet.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

JOINS MAP 4

McGREGOR GUIDED MISSILE RANGE

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

McGREGOR GUIDED MISSILE RANGE

Orogrande

Rattlesnake Hill

PERSHING FIRST-STAGE IMPACT AREA (TEMPORARY CLOSINGS ONLY)

FORT BLISS MILITARY RESERVATION

McGREGOR GUIDED MISSILE RANGE

TULAROSA VALLEY

OTERO MESA

McGREGOR GUIDED MISSILE RANGE

JOINS MAP 2

PERSHING FIRING FAN (TEMPORARY CLOSINGS ONLY)

McGREGOR GUIDED MISSILE RANGE

HUECO MOUNTAINS

FORT BLISS MILITARY RESERVATION

Three Buttes

FORT BLISS MILITARY RESERVATION McGREGOR GUIDED MISSILE RANGE

JOINS MAP 1

JOINS MAP 2

JOINS MAP 3

JOINS MAP 3

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps

TRES HERMANOS · ESCONDIDO CANYON · ROGERS RUINS
ORGAN PEAK · WHITE SANDS · OROGRANDE · PENDEJO WASH · PRATHER RANCH (Pictorial: Series V7810)
LA MESA · NEWMAN · DESERT · BASSETT LAKE
FORT BLISS · HUECO TANKS
Series V781 · Series V782

Scale 1:50,000

CONTOUR INTERVAL
Sheets 4748 I, 4748 II
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET
Sheets 4848 III, 4848 IV
50 FEET

# MAP 3
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## NON-URBAN CULTURE FEATURES

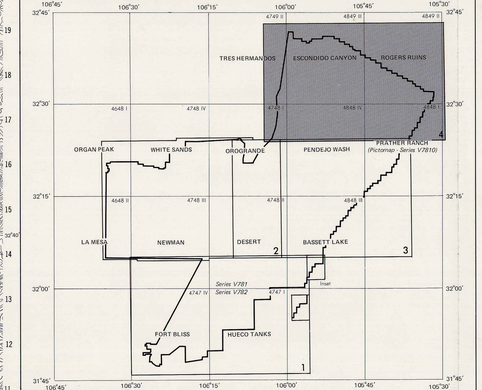
- Tower (observation, guard, range)
- Radio tower
- Microwave tower
- Water tower
- Windpump
- Theodolite station
- Tower (use unknown)
- VOR station
- Building
- Monument
- Ruin
- Sanitary fill
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- Oxidation pond
- Sewage disposal plant
- Power substation
- Bunker
- Ammunition bunker
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- Launcher site
- Observation post/bunker
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- Aqueduct (elevated)
- Fence
- Moving target
- I — Power line
- T — Telephone line
- P — Cable (underground), electric
- Revetment
- T P — Utility line, dual purpose
- Windpump ruin
- Cattle watering trough
- Earth berm/silt trap
- Instrumentation site
- Missile carriage structure
- Antenna field
- Range target

NOTES:
1) Numbers on map refer to entry in table.
2) Symbols omitted from the legend do not appear on this sheet.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# MAP 4
# FORT BLISS, TEXAS
# TERRAIN ANALYSIS
## NON-URBAN CULTURE FEATURES

INDEX TO SHEETS
1:50,000 Series V781, V782, V7810
and Four Study Area Maps




Tower (observation, guard, range)
Radio tower
Microwave tower
Water tower
Windpump
Theodolite station
Tower (use unknown)
VOR station
Building
Monument
Ruin
Sanitary fill
Tank
Oxidation pond

Sewage disposal plant
Power substation
Bunker
Ammunition bunker
Gas chamber
Inflight control site
Launcher site
Observation post/bunker
Radar
Cemetery
Abandoned airstrip
Ammunition dump
Aqueduct (elevated)
Fence

Moving target
Power line
Telephone line
Cable (underground), electric
Revetment
Utility line, dual purpose
Windpump ruin
Cattle watering trough
Earth berm/silt trap
Instrumentation site
Missile carriage structure
Antenna field
Range target

NOTES: 1) Numbers on map refer to entry in table.
2) Symbols omitted from the legend do not appear on these sheets.

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

Scale 1:50,000
1 0 1 2 3 Statute Miles
1000 500 0 1000 2000 3000 Meters

CONTOUR INTERVAL
Sheet 4748 I
40 FEET WITH SUPPLEMENTARY CONTOURS AT 20 FEET
Sheet 4749 II
50 FEET WITH SUPPLEMENTARY CONTOURS AT 25 FEET
Sheet 4848 I
200 FEET WITH SUPPLEMENTARY CONTOURS AT 100 FEET
Sheet 4849 II
40 FEET
Sheets 4848 IV, 4849 III
50 FEET

JOINS MAP 2 JOINS MAP 3 JOINS MAP 3

# III. OFF-POST FEATURES

## A. AIRFIELDS

There are two airfields within a 50-mile radius of Fort Bliss capable of handling troop-cargo transport aircraft equivalent to the C-130A Hercules. The largest, El Paso International Airport, is approximately 4 kilometers (2.5 miles) southeast of the Main Post; four commercial airlines provide service to the airport. Las Cruces-Crawford Airport is approximately 70 kilometers (43.5 miles) northwest of Fort Bliss; only charter service is available.

| MAP NUMBER AND NAME; LOCATION; TYPE; AND CLASSIFICATION | ELEVATION AND STATUS | RUNWAY DESCRIPTION | TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION | BUILDING DESCRIPTION | POL FACILITIES | NAVIGATIONAL AIDS | REMARKS |
|---|---|---|---|---|---|---|---|
| 1. El Paso International Airport, El Paso, Texas; 31° 48'N, 106° 23'W; Airfield; Civil. | Runway elevation 1206m (3956 ft); Operational. | Northeast-southwest runway (Rwy 4-22): 3686 x 46 m (12,094 x 150 ft); azimuth 038°-218°; weight bearing capacity S100, T180, ST175, TT350*; asphalt surface in good condition.<br>East-west runway (Rwy 8-26): 2746 x 46 m (9008 x 150 ft); azimuth 081°-261°; weight bearing capacity S100, T180, ST175, TT350; asphalt surface in good condition. | Taxiways: Three parallel taxiways 46 m (150 ft) wide; weight bearing capacity TT350; asphalt surface in good condition.<br><br>Parking Area, Apron, and Hardstand: Approximately 195,090 m² (2,100,000 ft²) total area; weight bearing capacity same as runways; asphalt surface in good condition. | Hangars:<br>City-owned: Hangar No. 4, 1858 m² (20,000 ft²), metal; hangar No. 7, 4123 m² (44,380 ft²), metal, currently reserved for use by El Paso Natural Gas Company and the US Army; 12 T-hangars, total 11,705 m² (126,000 ft²), 10 stalls each, metal.<br>Privately-owned: International Airmotive, 1700 m² (18,300 ft²), metal; Standard Enterprise, 743 m² (8000 ft²), metal; Finco, 929 m² (10,000 ft²), metal; Amigos Properties, 2313 m² (24,900 ft²), metal; El Paso Air Limited, 1141 m² (12,282 ft²), metal.<br><br>Maintenance buildings:<br>City-owned: Airport maintenance garage, 680 m² (7320 ft²), metal; FAA field maintenance, 251 m² (2700 ft²), metal.<br>Privately-owned: Continental Airlines shop, 223 m² (2400 ft²), metal.<br><br>Administration and Terminal buildings:<br>City-owned: Transient terminal, 886 m² (9534 ft²), masonry; El Paso International Airport terminal, 18,386 m² (197,909 ft²), masonry.<br>Privately-owned: Southwest Air Rangers, 2343 m² (25,225 ft²), metal; International Airmotive, 2992 m² (32,208 ft²), metal; both are fixed base operator structures.<br><br>Other buildings:<br>City-owned: Fuel quality control office, 9 m² (96 ft²), masonry; central receiving warehouse, 480 m² (5170 ft²), masonry.<br>Privately-owned: Approximately 40 commercial, industrial, and institutional buildings of various construction materials located on airport property, including two industrial park areas. | Fuels:<br>US aviation fuels (MIL SPECS): Fuel grade 115/145; jet fuel JP-4 with icing inhibitor.<br>Commercial aviation fuels: Jet fuel ASTM Type A with icing inhibitor; fuel grades 80/87, 115/145, 100/130; jet fuel ASTM Type A-1 without icing inhibitor; jet fuel ASTM Type B. El Paso International Airport supplies contract fuel. Low pressure oxygen servicing available.<br><br>Jet aircraft (USAF) starting units: Two Electrical A-3 units; one B-10 electrical unit; two combination air and electrical MA-IA units, one USN NCPP-105 combined air and electrical unit.<br><br>Storage and dispensing facilities: Six underground storage tanks, 94,625 liter (25,000 gallon) capacity each, at four loading dock locations; four pumping locations; nine fuel trucks, 18,925 liter (5000 gallon) capacity each. | Control tower: 46 m (152 ft) high.<br><br>Communications: Ultra high frequency (UHF) and very high frequency (VHF) radio, stage III radar service (El Paso), El Paso approach and departure control.<br><br>Radio aids to navigation: VHF omnidirectional radio range (VOR) unusable, tactical air navigation equipment (TACAN) unusable; nondirectional radio beacon (NDB); instrument landing system (ILS).<br><br>Lights: Rotating beacon; runway lights; high-intensity runway and approach lights; sequenced flashing lights and runway end identifier lights (REIL) (threshold strobe lights). Airport boundary not lighted. | Aerodrome is partially covered by USAF Notice to Airmen System (NOTAM), but does not maintain a military NOTAM File. Steeply rising terrain 8.3 kilometers (4.5 nautical miles) northwest of airport. Noise abatement program in effect west and south of airport.<br>Twenty-year master plan for airport expansion being completed. Details of this plan unavailable. |
| 2. Las Cruces-Crawford Airport, Las Cruces, New Mexico; 32° 17' N, 106° 55'W; Airfield; Civil. | Runway elevation 1358m (4454 ft); Operational. | Northwest-southeast runway (Rwy 12-30): 2286 x 46 m (7500 x 150 ft); azimuth 120°-300°; weight bearing capacity S70, T120, ST152, TT230; asphalt surface in good condition.<br>Northeast-southwest runway (Rwy 4-22): 2286 x 46 m (7500 x 150 ft); azimuth 038°-218°; weight bearing capacity same as above; asphalt surface in good condition.<br>East-west runway (Rwy 8-26): 1850 x 46 m (6071 x 150 ft); azimuth 078°-258°; weight bearing capacity same as above; asphalt surface in good condition. | Taxiways: Four taxiways: one 12 m (40 ft) wide, parallel to Rwy 8-26; weight bearing capacity S70, T120, ST 152, TT230; one 15 m (50 ft) wide, perpendicular to Rwy 8-26, weight bearing capacity same as above; two 15 m (50 ft) wide, parallel to Rwys 12-26 and 4-22 from their intersection with the perpendicular taxiway; all have asphalt surfaces in good condition.<br><br>Parking Area, Apron, and Hardstand: Approximately 26,012 m² (280,000 ft²) of parking, apron, and hardstand area; asphalt surface in good condition. | Hangars:<br>Privately-owned: One T-hangar, approximately 780 m² (8400 ft²), seven stalls, metal; two T-hangars each 1115 m² (12,000 ft²), ten stalls each, both metal; ten-aircraft shelter (covered structure with no walls), 1087 m² (11,700 ft²), metal.<br><br>Maintenance buildings:<br>Privately-owned: Shop area building, 178 m² (1920 ft²), metal; maintenance building, 446 m² (4800 ft²), metal.<br><br>Administration and Terminal buildings:<br>City-owned: Airport administration building, 167 m² (1800 ft²), masonry. | Fuels:<br>Commercial aviation fuels: Fuel grades 80/87, 100/130; jet fuel ASTM Type A; provided as contract fuel.<br><br>Storage and dispensing facilities: Three above-ground storage tanks, 34,065 liter (9000 gallon) capacity each, one tank each for the three available fuel types.<br><br>Jet fuel dispensed through a fixed point; aviation fuels dispensed remotely by one truck, 3785 liter (1000 gallon) capacity. | Communications: UHF and VHF radio, stage III radar service (El Paso), El Paso approach and departure control.<br><br>Radio aids to navigation: Nondirectional radio beacon (NDB). | New terminal building under construction. Thirty additional T-hangar stalls planned. |

*NOTE: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.
S - Runway weight bearing capacity for aircraft with single wheel type landing gear (C-47, F-100).
T - Runway weight bearing capacity for aircraft with twin wheel type landing gear (C-9A).
ST - Runway weight bearing capacity for aircraft with single tandem landing gear (C-130).
TT - Runway weight bearing capacity for aircraft with twin tandem type (including quadricycle) landing gear (B-57, C-135).
For further information, see DOD Flight Information Publication (Enroute IFR Supplement United States).

## B. URBAN AREAS

There are three urban areas with populations of 2500 or greater within a 50-mile radius of Post Headquarters at Fort Bliss: El Paso, Texas; Las Cruces, New Mexico; and Fabens, Texas. El Paso, Texas, the largest of the three cities, has a current estimated population of 386,000 and is adjacent to Fort Bliss. The 1970 census ranked El Paso as the fifth largest city in Texas and forty-fifth in the nation. During the 1960's, El Paso was one of the fastest growing urban areas in the country, but 1970 data indicate that the rate of growth has declined considerably.

Las Cruces, New Mexico, approximately 53 kilometers (33 miles) north of Fort Bliss on the Rio Grande River, is the third largest city in New Mexico, with a population of 46,639 (1970 census).

Fabens, Texas, 43 kilometers (27 miles) southeast of Fort Bliss, is an unincorporated urban area in eastern El Paso County. The estimated 1977 population of Fabens was 4000.

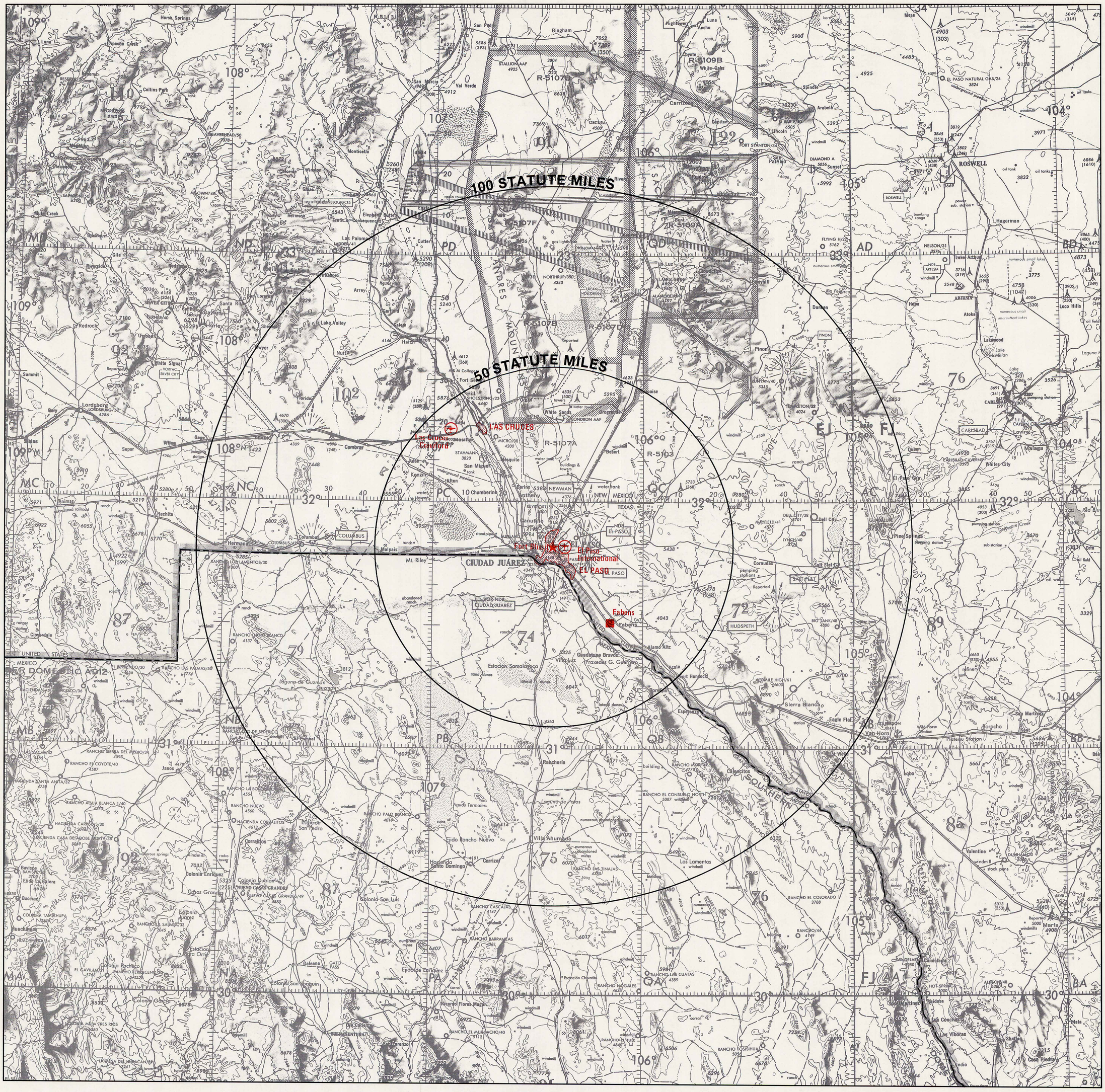
The city of Juarez, although in Mexico, is mentioned here because of its impact on El Paso and Fort Bliss. If the population of Juarez, 424,135, is added to that of El Paso, the resulting metropolitan region constitutes the largest urban area on the United States-Mexican border. Juarez and El Paso have interdependent economies and it is estimated that one-sixth of the labor force of Juarez works in the El Paso area.

| NAME AND LOCATION | POPULATION | HOUSING AVAILABILITY | EDUCATION FACILITIES | MEDICAL FACILITIES | RECREATION FACILITIES | PUBLIC UTILITIES | REMARKS |
|---|---|---|---|---|---|---|---|
| El Paso, Texas<br>31°47'N<br>106°27'W | 1970 Census: 322,261<br>Estimated 1977: 386,000<br>Projected 1980: 399,000 (low)<br>448,000 (high)<br>(1977 data) | Houses<br>Number of houses: 80,581<br>Number of houses rented: 8950<br>Average monthly rent: $225<br>Percent rental vacancies: 5%<br>New home starts, 1976: 2084<br>Average number of sales per year: 5258 (1977 data)<br>Average sale price: $35,892<br><br>Apartments<br>Number of apartments: 41,792<br>Average monthly rent: $152 (1 bdrm) to $250 (3 bdrm)<br>Average percent vacant: 8%<br>(1977 data) | Elementary Schools<br>Number of schools: 61<br>Enrollment capacity: 62,000<br>Current enrollment: 62,096<br>Projected enrollment, 1980: 64,500<br>Expansion plans: Classrooms will be added to several schools in El Paso District; three or four new schools planned for Ysleta District by 1980 (see remarks).<br><br>Junior High Schools<br>Number of schools: 13<br>Enrollment capacity: 12,000<br>Projected enrollment, 1980: 13,700<br>Expansion plans: One new school planned for Ysleta District by 1980 (see remarks).<br><br>High Schools<br>Number of schools: 13<br>Enrollment capacity: 29,500<br>Current enrollment: 30,553<br>Projected enrollment, 1980: 33,200<br>Expansion plans: One new school planned for Ysleta District by 1980 (see remarks).<br><br>Vocational Schools<br>Number of schools: 1<br>Current enrollment: 1085<br><br>Colleges and Universities<br>Number: 2 (University of Texas at El Paso and El Paso Community College)<br>Current enrollment: 24,961<br>(1977 data) | Hospitals<br>Total Number: 17<br>Total beds: 2783<br>Coronary care units: 104<br>Intensive care units: 49<br>Expansion plans: None<br><br>Doctors<br>Total number: 373<br>Doctor/population ratio: 1:1035<br><br>Dentists<br>Total Number: 122<br>Dentist/population ratio: 1:3164 | Number of parks: 83<br>Number of athletic fields: 44<br>Number of tennis courts: 49<br>Number of golf courses: 10 | Electric Power<br>Source: El Paso Electric Company<br>Distributor: El Paso Electric Company<br>Type: Three fossil-fuel steam generating stations. 1976 fuel mix was 74% natural gas, 11% fuel oil, and 15% coal.<br>Expansion plans: 15% interest in Palo Verde Nuclear Generating Station (Phoenix, AZ) scheduled to begin operations in 1982. Additional generating units planned for El Paso in 1981 and 1982.<br><br>Sewage Disposal<br>Number of treatment plants: 3<br>Total capacity: 189.3 million liters per day (50 million gallons per day)<br>Average daily flow: 160.9 million liters per day (42.5 million gallons per day)<br>Type of treatment: Primary and secondary<br>Expansion plans: Existing secondary treatment plant to be expanded from 94.6 to 98.4 million liters per day (25 to 26 million gallons per day) by 1980. One existing primary treatment plant to be upgraded to secondary treatment by 1981.<br><br>Heating Fuels<br>Type available: Natural gas, propane and fuel oil<br>Expansion plans: No plans for expansion<br><br>Water Supply<br>Source: Municipal system draws upon 120 wells and the Rio Grande River.<br>Capacity: 696.4 million liters per day (184 million gallons per day)<br>Adequacy of service: Good; peak load 537.5 million liters per day (142 million gallons per day)<br>Expansion plans: No major expansion plans, but new wells will probably be added. | Educational data are for the two public school systems in El Paso, the El Paso Independent School District and the Ysleta Independent School District. The student population level of the El Paso District has stabilized in the past several years and is expected to remain at existing levels in the foreseeable future. No overcrowding problems exist in the El Paso District. The direction of El Paso's growth, however, has been focused toward the eastern portions of the city within the Ysleta School District. This district has severe overcrowding conditions; the situation is expected to continue into the early 1980's. The Ysleta District has expanded and is increasing the number of schools and utilizing portable classroom units to keep pace with growing enrollment.<br>Data for medical facilities include William Beaumont Army Medical Center at Fort Bliss. |

# B. URBAN AREAS (Continued)

| NAME AND LOCATION | POPULATION | HOUSING AVAILABILITY | EDUCATION FACILITIES | MEDICAL FACILITIES | RECREATION FACILITIES | PUBLIC UTILITIES | REMARKS |
|---|---|---|---|---|---|---|---|
| Las Cruces,<br>New Mexico<br>32°20'N<br>106°50'W | 1970 Census: 37,857<br>Estimated 1977: 46,639<br>Projected 1980: 50,900<br>(1977 data) | Houses<br>Number of houses: 9530<br>Number of houses rented: 20<br>Average monthly rent: $140<br>Percent rental vacancies: 1%<br>New home starts, 1976: 268<br>Average number of sales per year: 200<br>Average sale price: $27,600<br><br>Apartments<br>Number of apartments: 4298<br>Average monthly rent: $125<br>Average percent vacant: 5%<br>(see remarks) | Elementary Schools<br>Number of schools: 17<br>Enrollment capacity: 7331<br>Current enrollment: 7063<br>Projected enrollment, 1980: 7746<br>Expansion Plans: 20 classrooms to be added to existing facilities to increase capacity to 7811.<br><br>Junior High Schools<br>Number of schools: 5<br>Enrollment capacity: 4200<br>Current enrollment: 4034<br>Projected enrollment, 1980: 4200<br>Expansion plans: None<br><br>High Schools<br>Number of schools: 2<br>Enrollment capacity: 4200<br>Current enrollment: 4140<br>Projected enrollment, 1980: 4200<br>Expansion plans: None<br><br>Vocational Schools<br>Number of schools: 1 (Dona Ana Branch of New Mexico State University)<br>Current enrollment: 1050<br><br>Colleges and Universities<br>Number: 1 (New Mexico State University)<br>Current enrollment: 11,423<br>(1977 data) | Hospitals<br>Total number: 1<br>Total beds: 160<br>Coronary care units: 7<br>Intensive care units: 4<br>Expansion plans: None<br><br>Doctors<br>Total number: 69<br>Doctor/population ratio: 1:676<br><br>Dentists<br>Total number: 19<br>Dentist/population ratio: 1:2455 | Number of parks: 14<br>Number of athletic fields: 7<br>Number of tennis courts: 16<br>Number of golf courses: 2 | Electric Power<br>Source: El Paso Electric Company<br>Distributor: El Paso Electric Company<br>Type: Three fossil-fuel steam generating stations. 1976 fuel mix was 74% natural gas, 11% fuel oil, and 15% coal.<br>Expansion plans: 15% interest in Palo Verde Nuclear Generating Station (Phoenix, AZ) scheduled to begin operations in 1982. Additional generating units planned for El Paso in 1981 and 1982.<br><br>Sewage Disposal<br>Number of treatment plants: 1<br>Total capacity: 18.9 million liters per day (5 million gallons per day)<br>Average daily flow: 19.7 million liters per day (5.2 million gallons per day)<br>Type of treatment: Advanced secondary (activated sludge)<br>Expansion plans: See remarks.<br><br>Heating Fuels<br>Type available: Natural gas, propane, butane, and fuel oil<br>Expansion plans: Natural gas distribution system being expanded. Other fuels adequate for current demand.<br><br>Water Supply<br>Source: Municipal system (deep wells)<br>Capacity: 83.3 million liters per day (22 million gallons per day)<br>Adequacy of service: Excellent; peak load 71.9 million liters per day (19 million gallons per day)<br>Expansion plans: When funding is available. | Data pertaining to housing market (monthly rents, number for rent, and sales per year) are from July 1974. All other data were current for 1977.<br>Average daily flow of sewage presently exceeds the current design capacity of the treatment plant. The effluent leaving the plant does not meet established water quality standards. The city of Las Cruces has implemented an interim program to partially alleviate this problem. Funding needed to completely overcome existing treatment plant deficiencies is not presently available. It is estimated by city officials that when funds are obtained, it will take approximately five years to implement a plan to expand the plant to a level where capacity would meet flow levels. |
| Fabens, Texas<br>30°31'N<br>106°07'W | 1970 Census: 3241<br>Estimated 1977: 4000<br>Projected 1980: 5000<br>(1977 data) | Houses<br>Number of houses: 815<br>Number of houses rented: 302<br>Average monthly rent: $48<br>Percent rental vacancies: No data<br>New home starts, 1976: No data<br>Average number of sales per year: No data<br>Average sale price: No data<br>(1970 data)<br><br>Apartments<br>None<br>(1970 data) | Elementary Schools<br>Number of schools: 2<br>Enrollment capacity: 950<br>Current enrollment: 848<br>Projected enrollment, 1980: 900<br>Expansion Plans: None<br><br>Junior High Schools<br>Number of schools: 1<br>Enrollment capacity: 300<br>Current enrollment: 248<br>Projected enrollment, 1980: 300<br>Expansion plans: None<br><br>High Schools<br>Number of schools: 1<br>Enrollment capacity: 500<br>Current enrollment: 452<br>Projected enrollment, 1980: 500<br>Expansion plans: None<br><br>Vocational Schools<br>Number of schools: None<br><br>Colleges and Universities<br>Number: None | Hospitals<br>Total Number: None<br><br>Doctors<br>Total Number: 2<br>Doctor/population ratio: 1:2000<br><br>Dentists<br>Total Number: 1<br>Dentist/population ratio: 1:4000 | Number of parks: 1<br>Number of athletic fields: 2<br>Number of golf courses:1 | Electric Power<br>Source: El Paso Electric Company<br>Distributor: El Paso Electric Company<br>Type: Three fossil-fuel steam generating stations. 1976 fuel mix was 74% natural gas, 11% fuel oil, and 15% coal.<br>Expansion plans: 15% interest in Palo Verde Nuclear Generating Station (Phoenix, AZ) scheduled to begin operations in 1982. Additional generating units planned for El Paso for 1981 and 1982.<br><br>Sewage Disposal<br>Number of treatment plants: 1<br>Total capacity: 2.6 million liters per day (700,000 gallons per day)<br>Average daily flow: 1.3 million liters per day (350,000 gallons per day)<br>Type of treatment: primary and secondary<br>Expansion plans: None<br><br>Heating Fuels<br>Type available: Natural gas, propane, butane, and fuel oil<br>Expansion plans: None<br><br>Water Supply<br>Source: County water control and improvement district utilizing 3 wells.<br>Capacity: 9.5 million liters per day (2.5 million gallons per day)<br>Adequacy of Service: Good; peak load 3.4 million liters per day (900,000 gallons per day), average load 1.9 million liters per day (500,000 gallons per day)<br>Expansion plans: Third well and storage tank added in 1978; future plans include replacement of old water mains. | Educational data are for the Fabens Independent School District.<br>Housing data were available only from 1970 Census of Housing. Current estimates obtained from local officials indicate no more than 1500 total housing units existed in Fabens in 1977. 79% of housing structures contain one unit; 19% contain two or more units; and the remaining 2% are mobile homes. There are no apartment units.<br>Outpatient health services are provided by a county health center. Hospital care is obtained through facilities in El Paso. |

# FORT BLISS, TEXAS
# TERRAIN ANALYSIS




## OFF-POST FEATURES

- Cantonment Area
- Urban Area
- Airfield
- International Boundary

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under direction of the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. September 1978.

# IV. LIST OF SOURCES


## DOCUMENTS

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9. **BUILDING INFORMATION SCHEDULE: FORT BLISS AND AAA RANGES.** 30 September 1976. Department of the Army, Chief of Engineers, Washington, DC.
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## MAPS

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## AERIAL PHOTOGRAPHS

123. **AERIAL PHOTOGRAPHY OF FORT BLISS, TEXAS.** Scale approximately 1:50,000. 15 September, 23 September 1969, and November, 1970. Flown by U.S. Air Force. Mission Numbers AF69-35 and AF71-13, respectively. Available at U.S. Army Engineer Topographic Laboratories, Terrain Analysis Center, Fort Belvoir, VA.

## PERSONAL COMMUNICATIONS

124. Mr. Augustine Alvarado. 9 December 1977. Directorate of Industrial Operations, Supply and Services Division, Fort Bliss, TX. Interview regarding fuel storage.
125. Mr. George Anderson. October 1977 - January 1978. Assistant State Soil Scientist, Soil Conservation Service, Albuquerque, NM. Telephone interviews required to obtain soils data for Texas-New Mexico border area.
126. Mr. Pete Atkins. 22 November 1977. Chief Range Enforcement Officer, Provost Marshall Office, Fort Bliss, TX. Interview regarding historical data on range facilities.
127. Mr. Orin Bailey. November 1977. State Soil Scientist, Soil Conservation Service, Albuquerque, NM. Telephone interview concerning availablility of unpublished soil surveys for Otero County, NM.
128. Mr. Johnny L. Baker. 30 November 1977. Chief of Maintenance Branch, Directorate of Communications and Electronics, Fort Bliss, TX. Interview regarding location and design of telephone lines.
129. Mr. James E. Barnett. 9 February 1978. Ysleta Independent School District, El Paso, TX. Telephone conversation regarding educational facilities and existing and projected enrollments in Ysleta Independent School District.
130. Mr. Jesus Barras. 28 November 1977. Engineering Plans, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding maps, plans, facilities, and utility lines at Fort Bliss.
131. Mr. T. Battaglia. 8 March 1978. Utilities Division, Directorate of Facilities Engineering, Fort Bliss, TX. Telephone interview concerning natural gas supply service capacity and utilization in cantonment areas.
132. 1LT Michael J. Bennington. 18 February 1978. Directorate Plans and Training, Airfield Operations Officer, Fort Bliss, TX. Telephone conversation regarding airfield facilities.
133. Mr. R.A. Bennett. 22 November 1977. Southern Union Gas Company, El Paso, TX. Letter concerning natural gas in El Paso.
134. Mr. E. G. Bentley. November 1977. Water Plant Foreman, Directorate of Facilities Engineering, Fort Bliss, TX. Personal interview regarding wells.
135. Mr. O. C. Brown. April 1978. Water Control and Improvement District Number 4, El Paso County, TX. Letter concerning water and sewer facilities in Fabens.

# IV. LIST OF SOURCES (continued)


136. Mr. Edward J. Buckles, 1 March 1978. Directorate of Industrial Operations, Family Housing Manager, Fort Bliss, TX. Letter concerning family housing units and plans at Fort Bliss.
137. Ms. G. Bush. 5 April 1978. Administration Office, Fabens Independent Schools, Fabens, TX. Telephone interview regarding education facilities in Fabens.
138. COL Buttner. 8 March 1978. Consolidated Troop Medical/Dental Facility, William Beaumont Army Medical Center, Fort Bliss, TX. Telephone interview concerning dental clinics and dispensaries at Fort Bliss.
139. Mr. Hal Cadie. 7 February 1978. Fixed Base Operator, Las Cruces-Crawford Airport, Las Cruces, NM. Telephone conversation regarding taxiways, parking area, POL facilities, buildings and expansion plans at Las Cruces airport.
140. Mr. Frank J. Call. 14 November 1977 and 4 January 1978. Executive Director, Organization of U.S. Border Cities, El Paso, TX. Letters concerning Ciudad Juarez.
141. CW3 William P. Chadderdon. 14 February 1978. Directorate of Plans and Training, Aviation Section, Fort Bliss, TX. Interview regarding helicopter landing zone data, and airfield support.
142. Mr. Robert Cole. 23 February 1978. Director of Communications—Electronics, Communications Manager, Operations Division, U.S. Army Communications Command Agency, Fort Bliss, TX. Letter concerning telecommunications facilities at Fort Bliss.
143. Mr. Ray Confer. 2 December 1977. Supervisor, Engineering Department, Southern Union Natural Gas Company, El Paso, TX. Interview regarding pipeline data.
144. Mr. Jim Conyers. 8 December 1977. Chief of Environmental Office, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding environmental factors affecting ranges.
145. Mr. Jonathan R. Cunningham, American Institute of Planners. 27 October 1977, Director, Department of Planning, Research and Development, City of El Paso, TX. Questionnaire and reports concerning existing and planned urban facilities in El Paso.
146. Dr. Glen D. DeGarmo. 22 November 1977. Staff Archaeologist, Environmental Office, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding historical and prehistorical data.
147. Dr. William A. Dick-Peddie. 6 November 1977. Professor of Ecology, New Mexico State University, Las Cruces, NM. Personal communication—subject—"Ecology of the Physiographic Regions of Fort Bliss".
148. Mr. Edmond R. Duke. 21 November 1977. New Business Manager, Mesilla Valley Division, El Paso Electric Company, Las Cruces, NM. Letter concerning electricity in Las Cruces.
149. Ms. Sharon L. Few. 10 November 1977. Special Projects Coordinator, City of Las Cruces, NM. Letter concerning points of contact for Off-Post Features data for Las Cruces.
150. Mr. Lewis Figuera. October 1977. Soil Scientist, Soil Conservation Service, Alamogordo, NM. Telephone interview concerning soil surveys in New Mexico (Dona Ana and Otero Countries).
151. Mr. Larry Fisher. 22 November 1977. Chief of Road and Railroad Maintenance Branch, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding fences, roads, railroads, airfield data, and range facilities.
152. Mr. Tarlton Francis. 8 November 1977. Executive Director, Las Cruces Memorial General Hospital, Las Cruces, NM. Questionnaire concerning hospital facilities in Las Cruces.
153. Mr. John Furman. 28 December 1977. Secretary-Treasurer, El Paso Hospital Council, El Paso, TX. Letter concerning special care facilities in El Paso hospitals.
154. Mr. Bruce Gaines. 15 November 1977. Director of 701 Planning, The West Texas Council of Governments, El Paso, TX. Letter and reports concerning growth and development of El Paso region.
155. Ms. Delfina Galloway. 30 November 1977. Chief Librarian, U.S. Army Air Defense Center, Fort Bliss, TX. Interview regarding historical data.
156. Mr. H. Gomez. 5 April 1978. Subdivision Coodinator, Office of County Engineer, El Paso County, TX. Telephone interview concerning growth and development of Fabens area.
157. MSG Nyles G. Graham. 23 November 1977. S-2 NCO, 2nd Squadron, 3rd Armored Cavalry Regiment, Fort Bliss, TX. Interview regarding range facilities, obstacles, and trafficability data.
158. Mr. Eddie Groth. 18 November 1977. Director of Information Services, New Mexico State University, Las Cruces, NM. Letter concerning university student enrollment.
159. Mr. A. W. Hamelstrom. November 1977. State Conservationist, Soil Conservation Service, Albuquerque, NM. Letter concerning soil descriptions, Otero County, NM.
160. Mr. L. A. Hansen. 23 November 1977. Security Assistance Officer, Directorate of Security, Fort Bliss, TX. Interview regarding maps, mapping corrections, and historical sites.
161. Mr. John T. Hickerson. 15 November 1977. General Manager, El Paso Water Utilities, Public Service Board, El Paso, TX. Letter concerning water supply and sewage treatment facilities.
162. Mr. Ken Holmes. November 1977. Bureau of Land Management District Office, Las Cruces, NM. Personal interview regarding water tanks.
163. Mr. Fred A. Ismond. 17 November 1977. Director of Utilities, City of Las Cruces, NM. Questionnaire concerning sewage treatment, water supply and heating fuels in Las Cruces.
164. Mr. Walter T. Jones. 19 October 1977. Airport Manager, El Paso International Airport, El Paso, TX. Questionnaire concerning existing airport facilities.
165. SSG James Jott. 23 November 1977. NCO, Mortuary Section, Institutional Supply Officer, Fort Bliss, TX. Interview regarding cemetery data.
166. Mr. Ron Karakula. November 1977. Roads Department, Directorate of Facilities Engineering, Fort Bliss, TX. Personal interview regarding tanks and springs.
167. Mr. James Kemp. November 1977—March 1978. Engineering Plans, Directorate of Facilities Engineering, Fort Bliss, TX. Personal and telephone interviews regarding maps, plans and facilities.
168. Dr. Amos J. Klump, DDS. 14 December 1977. President, Southwest District Dental Society. Letter concerning number of dentists in Las Cruces, NM.
169. Mr. Paul Lemons. 30 November 1977. Contract Agreements Office, Directorate of Industrial Operations, Fort Bliss, TX. Interview regarding support agreements.
170. Mr. Martin Lewis. 28 November 1977. Range Enforcement Officer, Provost Marshall Office, Fort Bliss, TX. Interview regarding historical data, and range facilities.
171. Mr. Heriberto Limas. 27 January 1978. Supervisory Realty specialist, Real Estate Management Engineering and Systems Branch, Engineering Resource Management Division, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding real estate data cards and improvements lists.
172. CPT Christopher L. Linger. 23 November 1977. S-2, 2nd Squadron, 3rd Armored Cavalry Regiment, Fort Bliss, TX. Interview regarding range obstacles, and trafficability data.
173. Mr. Oscar Loera. January-March 1978. McGregor Range Engineer Office and Utilities Division, Directorate of Facilities Engineering, Fort Bliss, TX. Personal and telephone interviews regarding range facilities and electrical systems.
174. CW3 P. J. McAuliffe. 9 December 1977. Directorate of Industrial Operations, Supply, and Services Division, Fort Bliss, TX. Interview regarding fuel systems.
175. Mr. Leonardo A. Mestas. 13 December 1977. Directorate of Plans and Training, Airfield Branch, Fuel Section, Fort Bliss, TX. Interview regarding fuel delivery.
176. Mrs. Glenda Miles. 20 October 1977. Research and Records Manager, El Paso Chamber of Commerce, El Paso, TX. Letter concerning population and housing data and points of contact for Off-Post Features data.
177. Mr. Johnny T. Miller. 7 December 1977. Chief, Engineering Section, El Paso Natural Gas Company, El Paso, TX. Interview regarding pipeline data.
178. Mr. Abelardo R. Navaretta. 23 November 1977. Traffic Manager, Directorate of Industrial Operations, Fort Bliss, TX. Interview regarding railroad capacities.
179. Mr. James Nicholopoulos. 28 November 1977. Communications and Electronics Section, Material Readiness Division, Directorate of Industrial Operations, Fort Bliss, TX. Interview regarding target descriptions.
180. Mr. Larry Nunez. 1 December 1977. District Office, Bureau of Land Management, Department of the Interior, Las Cruces, NM. Interview regarding fences, water storage tanks, and water lines.
181. Mr. John J. O'Connor. 13 December 1977. President, El Paso Board of Realtors, El Paso, TX. Letter concerning housing sales in El Paso.
182. Mr. Kenneth E. Ohler, November 1977. City Manager, Las Cruces, NM. Questionnaire concerning population and other data on Las Cruces.
183. Mr. Manny Ortega. November 1977—March 1978. Utilities Division, Directorate of Facilities Engineering, Fort Bliss, TX. Personal and telephone interviews regarding wells and water supply.
184. Mr. Ernesto Padillo. 28 November 1977. Engineering Plans, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding maps, plans, facilities, utility lines and many other cultural features at Fort Bliss.
185. Mr. Galen Palmore. 1 December 1977. Engineering Department, Mountain Bell Telephone Company, El Paso, TX. Interview regarding telephone lines.
186. Mr. Joy C. Perkins. 29 November 1977. Water Department, Orogrande, NM. Interview regarding Orogrande water line.
187. Mr. Raymond Price. November 1977. Deputy Engineer, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding facilities, plans, and maps.
188. Mr. Walter Pritchard. 23 November 1977. Directorate of Industrial Operations, Railroad Branch, Fort Bliss, TX. Interview regarding railroad operations.
189. Mr. Woodrow W. Proffitt. 27 January 1978. Chief of Logistics Branch, U.S. Army Air Defense Board, Fort Bliss, TX. Interview regarding Air Defense Board facilites.
190. Mr. Preston C. Radcliff. November 1977. Soil Conservation Service, Alamogordo, NM. Personal contact to obtain unpublished soils maps, Otero County, NM.
191. Mr. Jerry L. Rives. January 1978. Soil Scientist, Pecos, TX. Telephone interview concerning soils in El Paso County, TX.
192. Mr. E. M. Rohling. January-March 1978. Industrial Engineering Branch, Directorate of Industrial Operations, Fort Bliss, TX. Telephone interviews and letters concerning billeting and bachelor housing at Fort Bliss.
193. Dr. R. C. Schatzman, M.D. 16 December 1977. Las Cruces, NM. Letter concerning number of doctors in Las Cruces.
194. Mr. Mark K. Sideris. 16 November 1977. Director, Parks and Recreation Department, City of Las Cruces, NM. Letter concerning recreational facilities in Las Cruces.
195. Mr. Robert Snyder. February-March 1978. Public Informatin Office, El Paso Independent School District. El Paso, TX. Telephone conversations regarding El Paso public school facilities and existing and projected enrollments on and off-post.
196. Mr. Val Sorensen. 29 November 1977. Chief of Range Branch, Department of Planning and Training, Fort Bliss, TX. Interview regarding range regulations, photos, and locations.
197. Mr. John E. Stablein. 11 November 1977. Superintendent, Las Cruces Public Schools, Las Cruces, NM. Questionnaire concerning educational facilities in Las Cruces.
198. Mr. James L. Stremming, 9 December 1977. Engineering Department, El Paso Electric Company, El Paso, TX. Interview regarding power lines.
199. Mr. W. R. Thompson. February 1978. El Paso Independent Airport and Mass Transit Board, El Paso, TX. Letter and telephone conversation regarding El Paso International Airport facilities and plans.
200. Mr. Roy Uphem. 1 December 1977. Engineering Department, Southern Pacific Transportation Company, El Paso, TX. Interview regarding railroads.
201. Mr. Frank B. Ureno. 13 December 1977. Coordinator of Student Development, Dona Ana County Occupational Educational Branch, New Mexico State University, Las Cruces, NM. Questionnaire concerning the vocational student enrollment.
202. Mr. Jack E. Vaughn. 2 December 1977. Executive Director, El Paso Apartment Association, El Paso, TX. Letter concerning apartment rentals in El Paso.
203. Mr. V. S. Villereal. 8 March 1978. Directorate of Personnel and Community Acitivities, Sports, and Athletic Training Branch, Recreation Services Division, Fort Bliss, TX. Telephone interview concerning recreational facilities within cantonment areas.
204. MSG Eric C. Walker. 11 November 1977. NCOIC, Directorate of Plans and Training, Airfield Operations, Fort Bliss, TX. Telephone conversation regarding airfield operations and support.
205. CPT Robert W. Walker. November 1977-February 1978. Tasking Office, Department of Plans and Training, U.S. Army Air Defense Center and Fort Bliss, TX. Interviews regarding equipment support, personnel support, and coordination; liaison and coordination officer between SSI and Fort Bliss for this Terrain Analysis.
206. Dr. J. M. Whitaker. 17 October 1977. Superintendent, El Paso Independent School District, El Paso, TX. Questionnaire concerning school facilities.
207. Mr. Don White. November 1977. U.S. Geological Survey, El Paso, TX. Personal interview regarding ground water.
208. CPT Robert C. White, Jr. 23 November 1977. S-2, 3rd Armored Cavalry Regiment, Fort Bliss, TX. Interview regarding range obstacles.
209. LTC Sam Wilder. 23 November 1977. Commanding Officer, 2nd Squadron, 3rd Armored Cavalry Regiment, Fort Bliss, TX. Interview regarding maneuver problems, range improvements, and trafficability.
210. Mr. Fred Williams. 15 November 1977. Director of News and Information, El Paso Electric Company, El Paso, TX. Letter concerning electric production and consumption in El Paso.
211. Mr. Finis Warner. 30 January 1978. McGregor Range Engineering Office, Directorate of Facilities Engineering, Fort Bliss, TX. Interview regarding range facilities.
212. Mr. Harlan Westenberg. 18 October 1977. Industrial Development Director, Greater Las Cruces Industrial Development Board, Las Cruces, NM. Letter concerning points of contact for Off-Post Features data on Las Cruces.
213. Mr. D. B. Zumalt. 29 December 1977. Division Engineer, Southern Pacific Transportation Company, Tucson, AZ. Letter concerning Southern Pacific Transportation Company operations and descriptions.